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# ORGANOCHLORINE RESIDUE CONCENTRATIONS IN BLUBBER OF RINGED SEAL (*PHOCA HISPIDA*) FROM HOLMAN, NWT, 1972-1991: COMPILATION OF DATA AND ANALYSIS OF TRENDS

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# ORGANOCHLORINE RESIDUE CONCENTRATIONS IN BLUBBER OF RINGED SEAL (*PHOCA HISPIDA*) FROM HOLMAN, NWT, 1972 - 1991: COMPILATION OF DATA AND ANALYSIS OF TRENDS

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## ABSTRACT

Ringed seals (*Phoca hispida*) have been sampled from a subsistence hunt in Holman, NWT, at intervals during the last 25 years, for analysis of organochlorine (OC) concentrations in blubber. This report summarises the analytical data accumulated over this period. Re-analysis of archived samples and of calibration standards allows comparison of analyses carried out at different times or by different laboratories, and the demonstration of long-term trends.

## RESUME

Les phoques annelés (*Phoca hispida*) font l'objet d'un échantillonage dans les prises d'une chasse de subsistance à Holman (Territoires du Nord-Ouest) depuis 25 ans, à intervalles; l'échantillonage sert à doser les organochlorés dans le pannicule adipeux. Le présent rapport résume les données analytiques accumulées depuis le début. La réanalyse des échantillons archivés et des normes d'étalonnage permet de comparer les analyses effectuées à des périodes différentes ou par des laboratoires différents, et de mettre en évidence des tendances à long terme.

# INTRODUCTION

At intervals during the last 25 years, ringed seal (*Phoca hispida*) have been sampled from a subsistence hunt at Holman, NWT, for analysis of organochlorine (OC) residue concentrations. Some of these data have already been published (Addison and Smith, 1974; Addison et al., 1986). The detection of long term trends in OC concentrations from the early 1970's to the present is of particular interest, but is complicated by the evolution of analytical techniques; this has resulted in differing estimates of some OCs, especially the polychlorinated biphenyls (PCBs). For example, in the early 1970's, PCBs were estimated by comparing heights of a few major peaks (each of which included several compounds) separated by packed column gas-liquid chromatography (GLC) and measured by electron capture detection (ECD) with those in a commercial PCB mixture, such as Aroclor 1254. Now, individual congeners can be isolated by capillary column GLC, measured with more sensitivity and specificity by high resolution mass spectrometry (MS), and estimated by comparison with specific congener standards. These methods yield quite different estimates of total PCB concentrations in an environmental sample.

In this report, analyses of OC residue concentrations in Holman ringed seal blubber sampled in 1972, 1981, 1989 and 1991 are described. The 1972 and 1981 analyses were carried out by packed column GLC with ECD detection. Samples from 1989 were analysed by capillary column GLC with ECD and occasional structure confirmation by low resolution MS. Samples from 1991 were analysed by capillary column GLC and high resolution MS, and some 1981 samples were re-analysed by this method. The re-analysis of archived samples and analysis standard solutions by both approaches allow the reliable comparison of analyses over a twenty-year interval. The data summarised here will form the basis of future publications.

## METHODS

Analysis of 1972 and 1981 samples have been described previously (Addison and Smith, 1974; Addison et al., 1986). Samples from 1972 were analysed in 1973 at the Bedford Institute of Oceanography (BIO) using packed column GLC with electron capture detection. The 1981 samples were analysed at BIO in 1984 by the same procedure to allow direct comparison of the two data sets, but some additional analyses were made with capillary column GLC and ECD or, occasionally, low resolution MS detection to identify specific congeners. Samples taken in 1989 were analysed in 1991 at BIO by capillary column GLC with ECD (Addison et al., 1986) with some low resolution MS structure identification. The 1991 samples, and 17 samples archived from 1981, were analysed by Axys Laboratories (Sidney, BC) in 1994 using capillary column GLC and high resolution MS.

Samples from 1972 and 1981 were analysed for the main components of the DDT group of insecticides (*p,p'*-DDE and *p,p'*-DDT) and for PCBs estimated as Aroclor 1254 using external standards of the commercial mixture. Samples from 1989 were analysed for the DDT group and for hexachlorocyclohexanes (HCH), hexachlorobenzene (HCB), and *trans*-nonachlor (a chlordane component). The 1991 samples (and the archived 1981 samples) were analysed for all of the OCs listed above, plus a range of other OC pesticides. Concentrations of Aroclor 1254 equivalents in the 1991 and archived 1981 samples were calculated from the distribution of chlorobiphenyl (CB) congeners.

Data were analysed statistically using software from Statistica.

## RESULTS

1. Analytical data.

Tables 1 - 8 show DDT-group and PCB concentrations (expressed as Aroclor 1254) on a lipid weight and wet weight basis in male and female blubber samples from

1972, 1981, 1989 and 1991. Each data set was assigned a "group variable" (1 - 8) unique to year sampled and sex, for subsequent statistical analysis. In Tables 7 and 8, Aroclor 1254 concentrations in 1991 samples have been corrected as described below to be comparable to BIO analyses of 1972 and 1981 samples. Tables 9 and 10 show concentrations of HCB and of α-HCH and γ-HCH in female and male (respectively) 1981, 1989 and 1991 samples. β-HCH was usually absent (data not tabulated). α-HCH concentrations in the 1989 samples analysed at BIO were corrected to be comparable to the Axys 1981 and 1991 analyses, as described below. Table 11 shows concentrations of several other OC pesticides in 1981 and 1991 male and female samples. Heptachlor, α-endosulphan (I) and methoxychlor were not found in any of the samples (data not tabulated). Aldrin was detected only once (at 3.5 ng/g lipid in sample #30 from 1981) as was endrin (7.2 ng/g in sample #24 from 1991); these data are not tabulated. Table 12 shows CB congener distribution in 1981 and 1991 samples.

2. Comparison of analytical methods.

Table 13 shows a comparison of analyses of DDT-group residue concentrations in 17 blubber samples from 1981, analysed at BIO in 1984 and re-analysed by Axys in 1994. The ratios of concentrations reported for *p,p'*-DDE or *p,p'*-DDT were close to 1.0; *p,p'*-DDD was not reported in BIO analyses. Table 14 shows the results of a paired *t*-test of these comparisons; there was no statistically significant difference between the analyses. Elimination of the two obvious outliers (#15 and #43) from the *p,p'*-DDE comparisons changed the mean slightly (356 ng/g for Axys and 284 ng/g for BIO) but did not change the conclusion that the two laboratories' analyses did not differ significantly ($P = 0.41$). Total DDT-group residues differed almost significantly ($P = 0.08$); this was probably due to inclusion of *p,p'*-DDD and of *o,p'*- isomers in the Axys estimates. Lipid concentrations reported by Axys were also significantly lower than the BIO estimates; this is probably due at least partly to deterioration of samples in storage for about ten years. Table 15 shows results of analyses by Axys of standard solutions used at BIO; concentrations of *p,p'*-DDE and *p,p'*-DDT measured by Axys were within 11% of the nominal concentrations used by BIO. (Nominal concentrations of *p,p'*-DDD differed from measured

concentrations in the BIO standard solution, but residues of this metabolite were not reported in the 1972 and 1981 BIO analyses.)

These data show that analyses of *p,p'*-DDE and of *p,p'*-DDT did not differ significantly between the two laboratories, and so the reported concentrations in the eight data sets (Tables 1 - 8) are directly comparable.

Table 16 shows a comparison of PCBs estimated as Aroclor 1254 in 17 blubber samples taken in 1981 by the Axys and BIO laboratories. The two analytical methods yielded estimates differing by about 30%, but this difference was remarkably consistent. Fig. 1 shows a regression of Axys estimates on BIO estimates. Using this regression, Aroclor 1254 concentrations in the 1991 samples (analysed by Axys: Tables 7 and 8) were re-calculated as "BIO equivalents" to allow comparison with 1981 and 1972 analyses.

Table 15 shows that BIO estimates of α-HCH were about 25% higher than those measured by Axys; BIO estimates (in 1989 samples only) have been reduced by 25% ("corrected" data) for comparison with 1981 and 1991 data.

3. Temporal trends

Table 17 shows comparisons of age and blubber thickness in females from 1972 to 1981. The 1991 samples were significantly older than the 1989 samples, but no other statistically significant differences existed. As noted previously (Addison et al., 1986) blubber thickness in the 1981 samples was significantly greater than in the 1972 samples; it was also greater than in 1989. The age differences are unlikely to affect comparisons of OC residues as OC concentrations are independent of age in females (Addison and Smith 1974; Addison, 1989). However, the greater blubber thickness in the 1981 samples may "dilute" the OC concentrations in these samples, and we have noted previously (Addison et al., 1986) that this must be considered in comparing 1972 and 1981 samples. However, the thicker 1981 samples do not affect the overall decline in DDT group concentrations from 1972 to 1991 (Table 18; Figs. 2 and 3). Table 18 shows comparisons of *p,p'*-DDE and *p,p'*-DDT concentrations in female seals. Concentrations of *p,p'*-DDE were significantly higher ($P < 0.05$) in 1972 samples than in any of the later samples. Concentrations of *p,p'*-DDT declined steadily from 1972 to 1989, but samples from 1989

and 1991 did not differ significantly. Table 19 shows comparisons of age and blubber thickness in male seals from 1972 to 1991; as in the females, 1981 samples were in significantly better condition than those in other years. Table 20 (and Figs. 4 and 5) show trends in *p,p'*-DDE and *p,p'*-DDT concentrations from 1972 to 1991. The same general trends were seen in the male animals as in the females, though details of the trends tended to differ; this may be partly due to the confounding effects of age (the 1972 samples were older than those from 1981 and 1989).

The percentage of total DDT-group residues represented by *p,p'*-DDE may indicate the "age" of the DDT-group, as *p,p'*-DDE appears to be a "dead end" metabolite of *p,p'*-DDT. Table 21 (and Figs. 6 and 7) show changes in the percentage of the total DDT group represented by *p,p'*-DDE; the only significant change occurred between 1981 and 1989.

Table 22 (and Figs. 8 and 9) show trends in Aroclor 1254 concentrations in both male and females from 1972 to 1991. Concentrations declined in the interval 1972 - 1981, at which point they seem to have levelled off. Analyses of chlorobiphenyl (CB) congener distribution are shown in Figs. 10 - 12. Principal components analysis (PCA) showed no difference in congener distribution between sexes within years, and only small differences in the pattern of distrbution between 1981 and 1991 (Fig. 10). Figs. 11 and 12 show the distribution of major congeners (those representing over 2% of total congeners) in female and males, respectively in 1981 and 1991. Over this interval, the percentage of total congeners represented by CB 138 and 153 increased significantly in both sexes. In males only, CB 105 increased significantly between 1981 and 1991, and CB 52 and 90 declined significantly.

Table 23 (and Figs. 13 - 15) show trends in the concentrations of HCB, α-HCH and γ-HCH in females between 1981 and 1991. Concentrations of HCB declined significantly between 1981 and 1989, but those of α-HCH and γ-HCH did not. (Only one data point was available for γ-HCH in 1989 samples so its significance is questionable.) Similar trends were seen in males (Table 24, Figs. 16 - 18) except that there was a significant difference in γ-HCH concentrations between 1989 and 1991.

Tables 25 and 26 show statistical analyses of temporal trends in other OC pesticides in female and male samples between 1981 and 1991. The only statistically significant differences were in *cis*- and *trans*-nonachlor in males, but this was not seen in females.

4. Other Comparisons

Table 27 shows comparisons of *p,p'*-DDE and *p,p'*-DDT concentrations between sexes in 1972, 1981, 1989 and 1991. In all comparisons, except that for *p,p'*-DDT in 1989, males contained higher concentrations than females ($P < 0.05$). Table 28 shows similar comparisons for Aroclor 1254; again, males always contained significantly higher concentrations than females. Table 29 shows comparisons of HCB, α-HCH and γ-HCH concentrations in males and females; no significant differences existed between sexes. Tables 30 and 31 show comparisons of other OCs in males and females: males consistently contained higher concentrations than did females, but the differences were statistically significant for only some residues, usually oxychlordane, heptachlor epoxide and dieldrin. Regressions of *p,p'*-DDE, *p,p'*-DDT and PCB concentrations on age usually showed a negative or non-significant slope in females (Figs. 19 - 21), whereas in males, slopes were always positive and usually significantly different from zero (Figs. 22 - 24).

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Table 1: Biological variables, DDT-group residue and PCB concentrations in blubber from female Holman Is. ringed seals, *Phoca hispida*, 1972.

(Data from J. Dale lab. notebook March 1973; published in Addison and Smith, 1974; subset of data (marked *) in Addison et al., 1986.)

| Sample no. | Group | Year Sampled | Sex | Age (y) | Blubber thickness (cm) |
|---|---|---|---|---|---|
| 4* | 1 | 1972 | F | 4.0 | 3.0 |
| 13* | 1 | 1972 | F | 14.0 | 3.0 |
| 15* | 1 | 1972 | F | 13.0 | 3.0 |
| 17* | 1 | 1972 | F | 27.5 | NA |
| 18* | 1 | 1972 | F | 7.0 | 4.0 |
| 19* | 1 | 1972 | F | 19.0 | 4.0 |
| 51* | 1 | 1972 | F | 0.0 | 4.2 |
| 55* | 1 | 1972 | F | 13.0 | 4.0 |
| 57* | 1 | 1972 | F | 1.0 | 3.5 |
| 6? 16? | 1 | 1972 | F | 2.0 | NA |
| 41 | 1 | 1972 | F | 16.0 | NA |
| 42 | 1 | 1972 | F | 22.5 | NA |
| 49 | 1 | 1972 | F | 3.0 | NA |
| Mean | | | | 10.9 | 3.6 |
| S.D. | | | | 8.9 | 0.5 |
| Mean* | | | | 10.9 | 3.6 |
| S.D.* | | | | 8.9 | 0.5 |

NA: Not analysed

Cont'd./2

| Sample no. | Blubber lipid % wet wt. | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | PCB as Aroclor 1254 ng/g lipid. |
|---|---|---|---|---|---|
| 4* | 97.5 | 330 | 30 | 360 | 4040 |
| 13* | 97.9 | 160 | 180 | 340 | 1900 |
| 15* | 96.6 | 220 | 240 | 460 | 1590 |
| 17* | 93.3 | 190 | 250 | 440 | 1560 |
| 18* | 94.5 | 240 | 220 | 460 | 1340 |
| 19* | 91.4 | 440 | 320 | 760 | 1870 |
| 51* | 95.8 | 450 | 390 | 840 | 2120 |
| 55* | 98.5 | 250 | 280 | 530 | 1230 |
| 57* | 95.2 | 340 | 620 | 960 | 1690 |
| 6? 16? | 88.9 | 460 | 460 | 920 | NA |
| 41 | 94.3 | 140 | 280 | 420 | NA |
| 42 | 90.8 | 310 | 430 | 740 | NA |
| 49 | 92.9 | 310 | 420 | 730 | NA |
| Mean | 94.4 | 295 | 317 | 612 | 1927 |
| SD | 2.9 | 108 | 149 | 219 | 840 |
| Mean* | 95.6 | 291 | 281 | 572 | 1927 |
| S.D.* | 2.3 | 105 | 161 | 224 | 840 |

Cont'd./ 3

| Sample no. | *p,p'*-DDE ng/g wet wt. | *p,p'*-DDT ng/g wet wt. | Total DDT ng/g wet wt. | PCB as Aroclor 1254 ng/g wet wt. | *p,p'*-DDE% Total DDT |
|---|---|---|---|---|---|
| 4* | 322 | 29 | 351 | 3939 | 91.7 |
| 13* | 157 | 176 | 333 | 1860 | 47.1 |
| 15* | 213 | 232 | 444 | 1536 | 47.8 |
| 17* | 177 | 233 | 411 | 1455 | 43.2 |
| 18* | 227 | 208 | 435 | 1266 | 52.2 |
| 19* | 402 | 292 | 695 | 1709 | 57.9 |
| 51* | 431 | 374 | 805 | 2031 | 53.6 |
| 55* | 246 | 276 | 522 | 1212 | 47.2 |
| 57* | 324 | 590 | 914 | 1609 | 35.4 |
| 6? 16? | 409 | 409 | 818 | NA | 50.0 |
| 41 | 132 | 264 | 396 | NA | 33.3 |
| 42 | 281 | 390 | 672 | NA | 41.9 |
| 49 | 288 | 390 | 678 | NA | 42.5 |
| Mean | 278 | 297 | 575 | 1846 | 49.5 |
| SD | 98 | 137 | 198 | 827 | 14.4 |
| Mean* | 278 | 268 | 545 | 1846 | 52.9 |
| S.D.* | 97 | 153 | 209 | 827 | 15.9 |

Table 2: Biological variables, DDT-group residue and PCB concentrations in blubber from male Holman Is. ringed seals, *Phoca hispida*, 1972.

(Data from J. Dale lab. notebook March 1973; published in Addison and Smith, 1974; subset of data (marked *) in Addison et al., 1986.)

| Sample no. | Group | Year sampled | Sex | Age (y) | Blubber thickness (cm) |
|---|---|---|---|---|---|
| 2* | 2 | 1972 | M | 15.0 | 3.0 |
| 3* | 2 | 1972 | M | 3.0 | 2.0 |
| 7* | 2 | 1972 | M | 8.0 | 3.0 |
| 8* | 2 | 1972 | M | 16.0 | 3.5 |
| 10* | 2 | 1972 | M | 22.5 | 4.0 |
| 12* | 2 | 1972 | M | 12.0 | 4.5 |
| 28* | 2 | 1972 | M | 18.0 | 3.1 |
| 29* | 2 | 1972 | M | 17.0 | 2.5 |
| 46* | 2 | 1972 | M | 5.0 | 2.1 |
| 48* | 2 | 1972 | M | 6.0 | 3.2 |
| 52* | 2 | 1972 | M | 11.0 | 4.0 |
| 56* | 2 | 1972 | M | 1.0 | 2.5 |
| 1 | 2 | 1972 | M | 27.5 | 3.5 |
| 34 | 2 | 1972 | M | 27.5 | 3.3 |
| 53 | 2 | 1972 | M | 27.5 | 3.8 |
| Mean | | | | 14.5 | 3.2 |
| S.D. | | | | 9.0 | 0.7 |
| Mean* | | | | 11.2 | 3.1 |
| S.D.* | | | | 6.7 | 0.8 |

Cont'd./2

| Sample no. | Blubber lipid % wet wt. | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | PCB as Aroclor 1254 ng/g lipid |
|---|---|---|---|---|---|
| 2* | 95.9 | 1060 | 730 | 1790 | 5150 |
| 3* | 96.5 | 380 | 300 | 680 | 4350 |
| 7* | 97.4 | 370 | 230 | 600 | 3960 |
| 8* | 96.1 | 810 | 680 | 1490 | 5400 |
| 10* | 97.3 | 870 | 610 | 1480 | 5680 |
| 12* | 97.7 | 290 | 170 | 460 | 4130 |
| 28* | 93.3 | 890 | 440 | 1330 | 3580 |
| 29* | 95.2 | 1230 | 890 | 2120 | 3460 |
| 46* | 96.4 | 640 | 350 | 990 | 2550 |
| 48* | 96.8 | 280 | 450 | 730 | 1360 |
| 52* | 95.7 | 220 | 450 | 670 | 1570 |
| 56* | 92.5 | 900 | 550 | 1450 | 4800 |
| 1 | 97.1 | 1250 | 630 | 1880 | 5500 |
| 34 | 97.6 | 920 | 680 | 1600 | 3940 |
| 53 | 92.1 | 1340 | 1110 | 2450 | 4530 |
| Mean | 95.8 | 763 | 551 | 1315 | 3997 |
| S.D. | 1.8 | 380 | 252 | 606 | 1333 |
| Mean* | 95.9 | 662 | 488 | 1149 | 3833 |
| S.D.* | 1.6 | 344 | 214 | 533 | 1414 |

Cont'd./3

| Sample no. | *p,p'*-DDE ng/g wet wt. | *p,p'*-DDT ng/g wet wt. | Total DDT ng/g wet wt. | PCB as Aroclor 1254 ng/g wet wt. | *p,p'*-DDE % Total DDT |
|---|---|---|---|---|---|
| 2* | 1017 | 700 | 1717 | 4939 | 59.2 |
| 3* | 367 | 290 | 656 | 4198 | 55.9 |
| 7* | 360 | 224 | 584 | 3857 | 61.7 |
| 8* | 778 | 653 | 1432 | 5189 | 54.4 |
| 10* | 847 | 594 | 1440 | 5527 | 58.8 |
| 12* | 283 | 166 | 449 | 4035 | 63.0 |
| 28* | 830 | 411 | 1241 | 3340 | 66.9 |
| 29* | 1171 | 847 | 2018 | 3294 | 58.0 |
| 46* | 617 | 337 | 954 | 2458 | 64.6 |
| 48* | 271 | 436 | 707 | 1316 | 38.4 |
| 52* | 211 | 431 | 641 | 1502 | 32.8 |
| 56* | 833 | 509 | 1341 | 4440 | 62.1 |
| 1 | 1214 | 612 | 1825 | 5341 | 66.5 |
| 34 | 898 | 664 | 1562 | 3845 | 57.5 |
| 53 | 1234 | 1022 | 2256 | 4172 | 54.7 |
| Mean | 729 | 526 | 1255 | 3830 | 57.0 |
| S.D. | 358 | 235 | 568 | 1283 | 9.6 |
| Mean* | 632 | 466 | 1098 | 3675 | 56.3 |
| S.D.* | 325 | 203 | 504 | 1361 | 10.4 |

Table 3: Biological variables, DDT-group residue and PCB concentrations in blubber from female Holman ringed seals *Phoca hispida*, 1981.

(Data from M. Zinck lab. book #16 p. 23-41 (April May 1983); published in Addison et al., 1986.)

| Sample no. | Group | Year sampled | Sex | Age (y) | Blubber thickness (cm) |
|---|---|---|---|---|---|
| 5 | 3 | 1981 | F | 18.0 | 6.0 |
| 9 | 3 | 1981 | F | 6.0 | 5.0 |
| 15 | 3 | 1981 | F | 19.0 | 4.0 |
| 17 | 3 | 1981 | F | 1.0 | 3.5 |
| 19 | 3 | 1981 | F | 7.0 | 5.5 |
| 20 | 3 | 1981 | F | 3.0 | 4.0 |
| 24 | 3 | 1981 | F | 4.0 | 4.8 |
| 27 | 3 | 1981 | F | 5.0 | 3.9 |
| 30 | 3 | 1981 | F | 11.0 | 4.5 |
| 39 | 3 | 1981 | F | 3.0 | 4.0 |
| 42 | 3 | 1981 | F | 13.0 | 4.0 |
| 46 | 3 | 1981 | F | 25.0 | 3.9 |
| 49 | 3 | 1981 | F | 4.0 | 5.0 |
| 50 | 3 | 1981 | F | 8.0 | 4.7 |
| 54 | 3 | 1981 | F | 17.0 | 5.4 |
| Mean | | | | 9.6 | 4.5 |
| S.D. | | | | 7.2 | 0.7 |

Cont'd./2

| Sample no. | Blubber lipid % wet wt. | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | PCB as Aroclor 1254 ng/g lipid |
|---|---|---|---|---|---|
| 5 | 96.2 | 90 | 130 | 220 | 370 |
| 9 | 104.5 | 420 | 280 | 700 | 1220 |
| 15 | 103.3 | 40 | 200 | 240 | 420 |
| 17 | 93.4 | 70 | 130 | 200 | 280 |
| 19 | 97.4 | 140 | 130 | 270 | 460 |
| 20 | 97.8 | 130 | 140 | 270 | 530 |
| 24 | 97.5 | 140 | 140 | 280 | 480 |
| 27 | 99.8 | 140 | 130 | 270 | 500 |
| 30 | 95.7 | 170 | 240 | 410 | 760 |
| 39 | 99.6 | 160 | 130 | 290 | 470 |
| 42 | 94.2 | 160 | 200 | 360 | 740 |
| 46 | 92.2 | 160 | 240 | 400 | 840 |
| 49 | 95.4 | 0 | 590 | 590 | 800 |
| 50 | 94.9 | 170 | 180 | 350 | 710 |
| 54 | 96.2 | 70 | 160 | 230 | 340 |
| Mean | 97.2 | 137 | 201 | 339 | 595 |
| S.D. | 3.4 | 94 | 118 | 141 | 248 |

Cont'd./2

| Sample no. | Blubber lipid % wet wt. | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | PCB as Aroclor 1254 ng/g lipid |
|---|---|---|---|---|---|
| 5 | 96.2 | 90 | 130 | 220 | 370 |
| 9 | 104.5 | 420 | 280 | 700 | 1220 |
| 15 | 103.3 | 40 | 200 | 240 | 420 |
| 17 | 93.4 | 70 | 130 | 200 | 280 |
| 19 | 97.4 | 140 | 130 | 270 | 460 |
| 20 | 97.8 | 130 | 140 | 270 | 530 |
| 24 | 97.5 | 140 | 140 | 280 | 480 |
| 27 | 99.8 | 140 | 130 | 270 | 500 |
| 30 | 95.7 | 170 | 240 | 410 | 760 |
| 39 | 99.6 | 160 | 130 | 290 | 470 |
| 42 | 94.2 | 160 | 200 | 360 | 740 |
| 46 | 92.2 | 160 | 240 | 400 | 840 |
| 49 | 95.4 | 0 | 590 | 590 | 800 |
| 50 | 94.9 | 170 | 180 | 350 | 710 |
| 54 | 96.2 | 70 | 160 | 230 | 340 |
| Mean | 97.2 | 137 | 201 | 339 | 595 |
| S.D. | 3.4 | 94 | 118 | 141 | 248 |

Table 4: Biological variables, DDT-group residue and PCB concentrations in blubber from male Holman Is. ringed seals, *Phoca hispida*, 1981.

(Data from M. Zinck lab. notebook #16, p 23-41, April-May 1983; published in Addison et al., 1986.)

| Sample no. | Group | Year sampled | Sex | Age (y) | Blubber thickness (cm) |
|---|---|---|---|---|---|
| 6 | 4 | 1981 | M | 9.0 | 4.8 |
| 7 | 4 | 1981 | M | 9.0 | 4.6 |
| 8 | 4 | 1981 | M | 7.0 | 5.9 |
| 10 | 4 | 1981 | M | 6.0 | 5.0 |
| 22 | 4 | 1981 | M | 8.0 | 5.0 |
| 23 | 4 | 1981 | M | 4.0 | 4.0 |
| 26 | 4 | 1981 | M | 14.0 | 3.9 |
| 29 | 4 | 1981 | M | 6.0 | 4.8 |
| 31 | 4 | 1981 | M | 5.0 | 4.4 |
| 33 | 4 | 1981 | M | 2.0 | 4.4 |
| 41 | 4 | 1981 | M | 11.0 | 4.1 |
| 43 | 4 | 1981 | M | 15.0 | 3.6 |
| 44 | 4 | 1981 | M | 0.0 | 4.8 |
| 45 | 4 | 1981 | M | 10.0 | 4.7 |
| 47 | 4 | 1981 | M | 15.0 | 4.7 |
| 52 | 4 | 1981 | M | 21.0 | 2.9 |
| Mean | | | | 8.9 | 4.5 |
| SD | | | | 5.4 | 0.7 |

Cont'd./2

| Sample no. | Blubber lipid % wet wt. | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | PCB as Aroclor 1254 ng/g lipid |
|---|---|---|---|---|---|
| 6 | 100.6 | 730 | 260 | 990 | 1680 |
| 7 | 101.0 | 480 | 330 | 810 | 1270 |
| 8 | 100.3 | 170 | 130 | 300 | 550 |
| 10 | 98.4 | 170 | 110 | 280 | 600 |
| 22 | 99.1 | 400 | 290 | 690 | 1220 |
| 23 | 91.7 | 260 | 170 | 430 | 760 |
| 26 | 107.2 | 410 | 440 | 850 | 1450 |
| 29 | 99.8 | 170 | 210 | 380 | 630 |
| 31 | 99.1 | 220 | 210 | 430 | 810 |
| 33 | 102.8 | 170 | 190 | 360 | 660 |
| 41 | 97.1 | 330 | 340 | 670 | 1170 |
| 43 | 95.1 | 250 | 1130 | 1380 | 2780 |
| 44 | 96.3 | 200 | 240 | 440 | 730 |
| 45 | 91.2 | 430 | 500 | 930 | 1490 |
| 47 | 93.2 | 560 | 620 | 1180 | 1970 |
| 52 | 95.8 | 1490 | 1120 | 2610 | 3240 |
| Mean | 98.0 | 403 | 393 | 796 | 1313 |
| SD | 4.2 | 333 | 316 | 585 | 791 |

Cont'd./3

| Sample no. | *p,p'*-DDE ng/g wet wt. | *p,p'*-DDT ng/g wet wt. | Total DDT ng/g wet wt. | PCB as Aroclor 1254 ng/g wet wt. | *p,p'*-DDE% total DDT |
|---|---|---|---|---|---|
| 6 | 734 | 262 | 996 | 1690 | 73.7 |
| 7 | 485 | 333 | 818 | 1283 | 59.3 |
| 8 | 171 | 130 | 301 | 552 | 56.7 |
| 10 | 167 | 108 | 276 | 590 | 60.7 |
| 22 | 396 | 287 | 684 | 1209 | 58.0 |
| 23 | 238 | 156 | 394 | 697 | 60.5 |
| 26 | 440 | 472 | 911 | 1554 | 48.2 |
| 29 | 170 | 210 | 379 | 629 | 44.7 |
| 31 | 218 | 208 | 426 | 803 | 51.2 |
| 33 | 175 | 195 | 370 | 678 | 47.2 |
| 41 | 320 | 330 | 651 | 1136 | 49.3 |
| 43 | 238 | 1075 | 1312 | 2644 | 18.1 |
| 44 | 193 | 231 | 424 | 703 | 45.5 |
| 45 | 392 | 456 | 848 | 1359 | 46.2 |
| 47 | 522 | 578 | 1100 | 1836 | 47.5 |
| 52 | 1427 | 1073 | 2500 | 3104 | 57.1 |
| Mean | 393 | 382 | 774 | 1279 | 51.5 |
| SD | 320 | 299 | 557 | 751 | 11.8 |

Table 5: Biological variables and DDT-group residue concentrations in blubber from female Holman ringed seals *Phoca hispida*, 1989.

(Data from A. Dorey contract file HOL89.WK1.)

| Sample no. | Group | Year sampled | Sex | Age (y) | Blubber thickness (cm) |
|---|---|---|---|---|---|
| 14 | 5 | 1989 | F | 15.0 | 4.8 |
| 15 | 5 | 1989 | F | 1.0 | 2.1 |
| 17 | 5 | 1989 | F | 9.0 | 2.6 |
| 19 | 5 | 1989 | F | 9.0 | 2.0 |
| 21 | 5 | 1989 | F | 0.0 | 1.8 |
| 23 | 5 | 1989 | F | 13.0 | 4.8 |
| 24 | 5 | 1989 | F | 11.0 | 5.1 |
| 28 | 5 | 1989 | F | 9.0 | 4.6 |
| 29 | 5 | 1989 | F | 2.0 | 1.3 |
| 32 | 5 | 1989 | F | 11.0 | 5.4 |
| 37 | 5 | 1989 | F | 5.0 | 3.5 |
| 41 | 5 | 1989 | F | 10.0 | 3.7 |
| 48 | 5 | 1989 | F | 9.0 | 3.1 |
| 53 | 5 | 1989 | F | 9.0 | 5.1 |
| Mean | | | | 8.1 | 3.6 |
| SD | | | | 4.5 | 1.4 |

Cont'd./2

| Sample no. | Blubber lipid % wet wt. | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | *p,p'*-DDE ng/g wet wt. |
|---|---|---|---|---|---|
| 14 | 80.6 | 297 | 118 | 415 | 239 |
| 15 | 81.6 | 243 | 113 | 355 | 198 |
| 17 | 85.2 | 268 | 140 | 409 | 229 |
| 19 | 78.0 | 362 | 128 | 490 | 282 |
| 21 | 88.6 | 321 | 101 | 422 | 284 |
| 23 | 80.8 | 215 | 112 | 327 | 174 |
| 24 | 95.7 | 169 | 70 | 239 | 161 |
| 28 | 87.7 | 142 | 79 | 221 | 125 |
| 29 | 74.2 | 317 | 145 | 462 | 236 |
| 32 | 82.7 | 128 | 80 | 208 | 106 |
| 37 | 84.8 | 167 | 81 | 247 | 142 |
| 41 | 85.1 | 177 | 96 | 274 | 151 |
| 48 | 89.1 | 219 | 102 | 321 | 195 |
| 53 | 60.5 | 264 | 0 | 264 | 160 |
| Mean | 82.5 | 235 | 97 | 332 | 192 |
| SD | 8.2 | 73 | 36 | 94 | 56 |

| Sample no. | *p,p'*-DDT ng/g wet wt. | Total DDT ng/g wet wt. | *p,p'*-DDE % total DDT |
|---|---|---|---|
| 14 | 95 | 334 | 71.6 |
| 15 | 92 | 290 | 68.3 |
| 17 | 120 | 348 | 65.6 |
| 19 | 100 | 383 | 73.8 |
| 21 | 89 | 374 | 76.1 |
| 23 | 90 | 264 | 65.8 |
| 24 | 67 | 229 | 70.6 |
| 28 | 69 | 194 | 64.4 |
| 29 | 107 | 343 | 68.7 |
| 32 | 66 | 172 | 61.6 |
| 37 | 68 | 210 | 67.4 |
| 41 | 82 | 233 | 64.8 |
| 48 | 91 | 286 | 68.2 |
| 53 | 0 | 160 | 100.0 |
| Mean | 81 | 273 | 70.5 |
| SD | 28 | 75 | 9.3 |

Table 6: Biological variables and DDT-group residue concentrations in blubber from male Holman ringed seals, *Phoca hispida*, 1989.

(Data from A. Dorey contract file HOL89.WK1)

| Sample no. | Group | Year sampled | Sex | Age (y) | Blubber thickness (cm) |
|---|---|---|---|---|---|
| 11 | 6 | 1989 | M | 25.0 | 2.8 |
| 18 | 6 | 1989 | M | 6.0 | 3.8 |
| 20 | 6 | 1989 | M | 8.0 | 3.4 |
| 22 | 6 | 1989 | M | 0.0 | 1.5 |
| 26 | 6 | 1989 | M | 12.0 | 3.4 |
| 27 | 6 | 1989 | M | 10.0 | 4.4 |
| 30 | 6 | 1989 | M | 2.0 | 0.9 |
| 34 | 6 | 1989 | M | 8.0 | 4.1 |
| 35 | 6 | 1989 | M | 9.0 | 3.8 |
| 36 | 6 | 1989 | M | 7.0 | 1.8 |
| 39 | 6 | 1989 | M | 1.0 | 1.6 |
| 40 | 6 | 1989 | M | 9.0 | 3.9 |
| 42 | 6 | 1989 | M | 6.0 | 4.8 |
| 45 | 6 | 1989 | M | 20.0 | 1.9 |
| 52 | 6 | 1989 | M | 14.0 | 3.2 |
| 56 | 6 | 1989 | M | 1.0 | 1.1 |
| Mean | | | | 8.6 | 2.9 |
| SD | | | | 6.8 | 1.3 |

Cont'd./2

| Sample no. | Blubber lipid % wet wt. | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | *p,p'*-DDE ng/g wet wt |
|---|---|---|---|---|---|
| 11 | 85.9 | 1495 | 1023 | 2518 | 1284 |
| 18 | 84.6 | 212 | 79 | 291 | 179 |
| 20 | 83.4 | 250 | 97 | 347 | 209 |
| 22 | 93.2 | 590 | 178 | 769 | 550 |
| 26 | 51.6 | 398 | 202 | 601 | 206 |
| 27 | 88.1 | 133 | 61 | 195 | 117 |
| 30 | 79.4 | 292 | 172 | 464 | 232 |
| 34 | 82.8 | 141 | 63 | 204 | 117 |
| 35 | 87.5 | 377 | 154 | 530 | 329 |
| 36 | 81.8 | 551 | 148 | 698 | 450 |
| 39 | 83.2 | 500 | 161 | 661 | 416 |
| 40 | 89.2 | 201 | 117 | 318 | 180 |
| 42 | 84.6 | 140 | 0 | 140 | 118 |
| 45 | 77.7 | 1171 | 535 | 1707 | 910 |
| 52 | 87.1 | 728 | 379 | 1107 | 634 |
| 56 | 46.0 | 530 | 337 | 867 | 244 |
| Mean | 80.4 | 482 | 232 | 714 | 386 |
| SD | 12.9 | 383 | 251 | 625 | 325 |

Cont'd./3

| Sample no. | *p,p'*-DDT ng/g wet wt | Total DDT ng/g wet wt | *p,p'*-DDE % total DDT |
|---|---|---|---|
| 11 | 879 | 2163 | 59.4 |
| 18 | 67 | 246 | 72.8 |
| 20 | 81 | 289 | 72.1 |
| 22 | 166 | 716 | 76.8 |
| 26 | 104 | 310 | 66.3 |
| 27 | 54 | 171 | 68.6 |
| 30 | 137 | 369 | 62.9 |
| 34 | 52 | 169 | 69.1 |
| 35 | 135 | 464 | 71.0 |
| 36 | 121 | 571 | 78.8 |
| 39 | 134 | 550 | 75.7 |
| 40 | 104 | 284 | 63.3 |
| 42 | 0 | 118 | 100.0 |
| 45 | 416 | 1326 | 68.6 |
| 52 | 330 | 964 | 65.8 |
| 56 | 155 | 399 | 61.1 |
| Mean | 183 | 569 | 70.8 |
| SD | 212 | 531 | 9.6 |

**Table 7: Biological variables, DDT-group residue and PCB concentrations in blubber from female Holman ringed seals *Phoca hispida*, 1991.**

**(Data from Axys contract files 2894. Aroclor 1254 as "BIO Equivalents" calculated as described in text.)**

| Sample no | Group | Year sampled | Sex | Age (y) | Blubber thickness cm |
|---|---|---|---|---|---|
| 4 | 7 | 1991 | F | 12.0 | 4.3 |
| 6 | 7 | 1991 | F | 14.0 | 4.4 |
| 8 | 7 | 1991 | F | 10.0 | 4.2 |
| 10 | 7 | 1991 | F | 19.0 | 2.5 |
| 18 | 7 | 1991 | F | 26.0 | 5.7 |
| 19 | 7 | 1991 | F | NA | 4.5 |
| 25 | 7 | 1991 | F | 5.0 | 4.1 |
| Mean | | | | 14.3 | 4.2 |
| SD | | | | 7.3 | 0.9 |

NA: Not analysed

Cont'd./2

| Sample no | Lipid % wet wt. | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | PCB as Aroclor 1254 ng/g lipid |
|---|---|---|---|---|---|
| 4 | 100 | 220 | 56 | 280 | 540 |
| 6 | 100 | 100 | 58 | 163 | 280 |
| 8 | 98 | 100 | 42 | 146 | 260 |
| 10 | 95 | 110 | 91 | 218 | 360 |
| 18 | 84 | 180 | 68 | 263 | 450 |
| 19 | 88 | 120 | 46 | 170 | 250 |
| 25 | 89 | 230 | 100 | 352 | 420 |
| Mean | 93 | 151 | 66 | 227 | 366 |
| SD | 6 | 57 | 22 | 75 | 110 |

Cont'd./3

| Sample no | *p,p'*-DDE ng/g wet wt | *p,p'*-DDT ng/g wet wt | PCB as Aroclor 1254 ng/g wet wt. | PCB as Aroclor 1254 ng/g wet wt. (BIO Equivalent) | *p,p'*-DDE as % *p,p'*-DDE + *p,p'*-DDT |
|---|---|---|---|---|---|
| 4 | 220 | 56 | 540 | 842 | 79.7 |
| 6 | 100 | 58 | 280 | 405 | 63.3 |
| 8 | 98 | 41 | 255 | 362 | 70.4 |
| 10 | 105 | 86 | 342 | 509 | 54.7 |
| 18 | 151 | 57 | 378 | 584 | 72.6 |
| 19 | 106 | 40 | 220 | 304 | 72.3 |
| 25 | 205 | 89 | 374 | 562 | 69.7 |
| Mean | 141 | 61 | 341 | 510 | 69.0 |
| SD | 52 | 20 | 106 | 180 | 7.9 |

Table 8: Biological variables, DDT-group residue and PCB concentrations in blubber from male Holman ringed seals, *Phoca hispida*, 1991.

(Data from Axys contract files 2894. Aroclor 1254 as "BIO Equivalents" calculated as described in text.)

| Sample no | Group | Year sampled | Sex | Age (y) | Blubber thickness (cm) |
|---|---|---|---|---|---|
| 1 | 8 | 1991 | M | 7 | 4.6 |
| 3 | 8 | 1991 | M | 10 | 4.5 |
| 11 | 8 | 1991 | M | 14 | 3.6 |
| 13 | 8 | 1991 | M | 14 | 3.8 |
| 14 | 8 | 1991 | M | 14 | 3.3 |
| 15 | 8 | 1991 | M | 15 | 3.0 |
| 17 | 8 | 1991 | M | 20 | 2.6 |
| 21 | 8 | 1991 | M | 10 | 2.3 |
| 23 | 8 | 1991 | M | 10 | 2.0 |
| 24 | 8 | 1991 | M | 10 | 4.5 |
| 28 | 8 | 1991 | M | 11 | 3.7 |
| Mean | | | | 12.3 | 3.4 |
| SD | | | | 3.6 | 0.9 |

Cont'd./2
Cont'd./3

| Sample no | Lipid % wet wt | *p,p'*-DDE ng/g lipid | *p,p'*-DDT ng/g lipid | Total DDT ng/g lipid | PCB as Aroclor 1254 ng/g lipid |
|---|---|---|---|---|---|
| 1 | 100.0 | 250 | 49 | 302 | 510 |
| 3 | 90.0 | 280 | 110 | 404 | 590 |
| 11 | 98.0 | 120 | 56 | 180 | 340 |
| 13 | 91.5 | 545 | 210 | 775 | 930 |
| 14 | 92.0 | 380 | 180 | 583 | 860 |
| 15 | 90.0 | 590 | 130 | 748 | 880 |
| 17 | 89.0 | 330 | 120 | 474 | 630 |
| 21 | 88.0 | 330 | 110 | 462 | 730 |
| 23 | 90.0 | 360 | 160 | 551 | 690 |
| 24 | 85.0 | 270 | 120 | 414 | 610 |
| 28 | 75.5 | 320 | 105 | 454 | 760 |
| Mean | 89.9 | 343 | 123 | 486 | 685 |
| SD | 6.4 | 131 | 48 | 175 | 174 |

Cont'd./3

| Sample no | *p,p'*-DDE ng/g wet wt | *p,p'*-DDT ng/g wet wt | PCB as Aroclor 1254 ng/g wet wt | PCB as Aroclor 1254 ng/g wet wt. (BIO equivalent) | *p,p'*-DDE as % *p,p'*-DDE + *p,p'*-DDT |
|---|---|---|---|---|---|
| 1 | 250 | 49 | 510 | 792 | 83.6 |
| 3 | 252 | 99 | 531 | 827 | 71.8 |
| 11 | 118 | 55 | 333 | 494 | 68.2 |
| 13 | 499 | 192 | 851 | 1366 | 72.2 |
| 14 | 350 | 166 | 791 | 1265 | 67.9 |
| 15 | 531 | 117 | 792 | 1266 | 81.9 |
| 17 | 294 | 107 | 561 | 877 | 73.3 |
| 21 | 290 | 97 | 642 | 1015 | 75.0 |
| 23 | 324 | 144 | 621 | 979 | 69.2 |
| 24 | 230 | 102 | 519 | 806 | 69.2 |
| 28 | 242 | 79 | 574 | 899 | 75.3 |
| Mean | 307 | 110 | 611 | 962 | 73.4 |
| SD | 119 | 44 | 152 | 255 | 5.3 |

Table 9: HCB and HCH concentrations in female Holman ringed seal (*Phoca hispida*) blubber, 1981, 1989 and 1991

(1981 and 1991 data from Axys files contract 2894; 1989 data from A Dorey contract file HOL89.WK1, corrected as described in text.)

| Sample no. | Year sampled | Group | HCB ng/g lipid | α-HCH ng/g lipid | Corrected 1989 α-HCH ng/g lipid | γ-HCH ng/g lipid |
|---|---|---|---|---|---|---|
| 15 | 1981 | 3 | 37 | 93 | | 5.1 |
| 19 | 1981 | 3 | 51 | 190 | | 4.1 |
| 27 | 1981 | 3 | 24 | 180 | | ND |
| 30 | 1981 | 3 | 42 | 63 | | ND |
| 42 | 1981 | 3 | 51 | 140 | | 9.5 |
| 50 | 1981 | 3 | 34 | 250 | | 7.8 |
| 54 | 1981 | 3 | 33 | 105 | | ND |
| Mean 1981 | | | 38.9 | 146 | | 6.6 |
| SD 1981 | | | 9.9 | 65.0 | | 2.5 |
| 14 | 1989 | 5 | 20 | 131 | 105 | ND |
| 15 | 1989 | 5 | 16 | 1136 | 909 | ND |
| 17 | 1989 | 5 | 18 | 157 | 125 | ND |
| 19 | 1989 | 5 | 24 | 168 | 134 | ND |
| 21 | 1989 | 5 | 24 | 309 | 247 | ND |
| 23 | 1989 | 5 | 29 | 574 | 459 | 23.3 |
| 24 | 1989 | 5 | 37 | 188 | 151 | ND |
| 28 | 1989 | 5 | 15 | 154 | 123 | ND |
| 29 | 1989 | 5 | 0 | 434 | 347 | ND |
| 32 | 1989 | 5 | 19 | 135 | 108 | ND |
| 37 | 1989 | 5 | 19 | 110 | 88 | ND |
| 41 | 1989 | 5 | 19 | 97 | 78 | ND |
| 48 | 1989 | 5 | 24 | 173 | 138 | ND |
| 53 | 1989 | 5 | 0 | 124 | 99 | ND |
| Mean 1989 | | | 18.9 | 278 | 222 | 23.3 |
| SD 1989 | | | 9.7 | 283 | 226 | |

Cont'd./2

| Sample no. | Year sampled | Group | HCB ng/g lipid | α-HCH ng/g lipid | γ-HCH ng/g lipid |
|---|---|---|---|---|---|
| 4 | 1991 | 7 | 13 | 140 | 3.2 |
| 6 | 1991 | 7 | 27 | 230 | 8.2 |
| 8 | 1991 | 7 | 14 | 150 | 5.9 |
| 10 | 1991 | 7 | 25 | 280 | 19 |
| 18 | 1991 | 7 | 13 | 200 | 3.1 |
| 19 | 1991 | 7 | 19 | 170 | 6 |
| 25 | 1991 | 7 | 24 | 110 | 4 |
| Mean 1991 | | | 19.3 | 183 | 7.1 |
| SD 1991 | | | 6.1 | 58.2 | 5.6 |

ND: Not detected

Table 10: HCB and HCH concentrations in male Holman ringed seal (*Phoca hispida*) blubber in 1981, 1989 and 1991

(1981 and 1991 data from Axys files contract 2894; 1989 data from A Dorey contract file HOL89.WK1, corrected as described in text.)

| Sample no. | Year sampled | Group | HCB ng/g lipid | α-HCH ng/g lipid | Corrected 1989 α-HCH ng/g lipid | γ-HCH ng/g lipid |
|---|---|---|---|---|---|---|
| 6 | 1981 | 4 | 27 | 190 | | 19 |
| 7 | 1981 | 4 | 43 | 210 | | 15 |
| 8 | 1981 | 4 | 31 | 97 | | 1.3 |
| 22 | 1981 | 4 | 28 | 180 | | 7.4 |
| 28 | 1981 | 4 | 67 | 91 | | ND |
| 29 | 1981 | 4 | 38 | 250 | | ND |
| 31 | 1981 | 4 | 40 | 150 | | ND |
| 41 | 1981 | 4 | 57 | 210 | | 13 |
| 43 | 1981 | 4 | 19 | 260 | | 17 |
| 45 | 1981 | 4 | 34 | 220 | | 17 |
| 47 | 1981 | 4 | 24 | 200 | | 14 |
| Mean 1981 | | | 37 | 187 | | 13 |
| SD 1981 | | | 14 | 55 | | 6 |
| 11 | 1989 | 6 | 41 | 97 | 78 | ND |
| 18 | 1989 | 6 | 20 | 132 | 105 | ND |
| 20 | 1989 | 6 | 21 | 156 | 125 | ND |
| 22 | 1989 | 6 | 68 | 667 | 534 | 11 |
| 26 | 1989 | 6 | 23 | 305 | 244 | 22 |
| 27 | 1989 | 6 | 17 | 396 | 317 | 19 |
| 30 | 1989 | 6 | 20 | 500 | 400 | 24 |
| 34 | 1989 | 6 | 0 | 200 | 160 | ND |
| 35 | 1989 | 6 | 15 | 108 | 86 | ND |
| 36 | 1989 | 6 | 15 | 227 | 182 | ND |
| 39 | 1989 | 6 | 9 | 285 | 228 | ND |
| 40 | 1989 | 6 | 18 | 164 | 131 | ND |
| 42 | 1989 | 6 | 11 | 151 | 121 | ND |
| 45 | 1989 | 6 | 12 | 141 | 113 | ND |
| 52 | 1989 | 6 | 34 | 96 | 76 | ND |

Cont'd./2

| Sample no. | Year sampled | Group | HCB ng/g lipid | α-HCH ng/g lipid | Corrected 198 α-HCH ng/g lipid | γ-HCH ng/g lipid |
|---|---|---|---|---|---|---|
| 56 | 1989 | 6 | 36 | 676 | 541 | ND |
| Mean 1989 | | | 22 | 269 | 215 | 19 |
| SD 1989 | | | 16 | 193 | 155 | 6 |
| 1 | 1991 | 8 | 13 | 230 | | 5 |
| 3 | 1991 | 8 | 17 | 110 | | 5 |
| 11 | 1991 | 8 | 14 | 160 | | 4 |
| 13 | 1991 | 8 | 23 | 110 | | 4 |
| 14 | 1991 | 8 | 30 | 200 | | 8 |
| 15 | 1991 | 8 | 29 | 120 | | 3 |
| 17 | 1991 | 8 | 24 | 100 | | 4 |
| 21 | 1991 | 8 | 34 | 230 | | 7 |
| 23 | 1991 | 8 | 31 | 150 | | 5 |
| 24 | 1991 | 8 | 23 | 340 | | 23 |
| 28 | 1991 | 8 | 47 | 440 | | 20 |
| Mean 1991 | | | 26 | 199 | | 8 |
| SD 1991 | | | 10 | 108 | | 7 |

ND: Not detected

Table 11: Other OC concentrations in blubber from male and female Holman ringed seal (*Phoca hispida)*, 1981 and 1991.

(Data from Axys contract files 2894)

| Sample | Sex | Year sampled | Group | Oxy-chlordane ng/g lipid | *trans*-chlordane ng/g lipid | *cis*-chlordane ng/g lipid | *trans*-nonachlor ng/g lipid | *cis*-nonachlor ng/g lipid | Mirex ng/g lipid | Heptachlor epoxide ng/g lipid | Dieldrin ng/g lipid |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | 45 | 5.3 | 79 | 150 | 41 | 5.2 | 19 | 70 |
| 27 | F | 1981 | 3 | 93 | 4.8 | 8 | 56 | 7 | ND | 18 | 24 |
| 30 | F | 1981 | 3 | 130 | 1.2 | 17 | 100 | 13 | NDR | 21 | 50 |
| 42 | F | 1981 | 3 | 67 | ND | 23 | 95 | 14 | NDR | 18 | 49 |
| 50 | F | 1981 | 3 | 140 | 2.8 | 17 | 150 | 16 | NDR | 43 | 42 |
| 54 | F | 1981 | 3 | 46 | 1.9 | 19 | 105 | 17 | NDR | 21 | 45 |
| Mean | | | | 87 | 3.2 | 27 | 109 | 18 | 5.2 | 23 | 47 |
| SD | | | | 41 | 1.8 | 26 | 36 | 12 | | 10 | 15 |
| 6 | M | 1981 | 4 | 190 | 16.0 | 230 | 430 | 79 | 9.2 | 60 | 140 |
| 7 | M | 1981 | 4 | 180 | NDR | 100 | 180 | 39 | 6.2 | 54 | 130 |
| 8 | M | 1981 | 4 | 86 | NDR | 36 | 67 | 12 | 2.0 | 23 | 49 |
| 22 | M | 1981 | 4 | 210 | 8.0 | 16 | 260 | 28 | NDR | 26 | 28 |
| 29 | M | 1981 | 4 | 98 | 5.9 | 32 | 190 | 31 | ND | 27 | 48 |
| 31 | M | 1981 | 4 | 84 | 2.5 | 22 | 200 | 29 | NDR | 39 | 59 |
| 41 | M | 1981 | 4 | 190 | 2.5 | 36 | 160 | 24 | NDR | 41 | 89 |
| 43 | M | 1981 | 4 | 400 | 14.0 | 130 | 1100 | 140 | 32.0 | 94 | 130 |

Cont'd./2

| Sample | Sex | Year sampled | Group | Oxy-chlordane ng/g lipid | *trans*-chlordane ng/g lipid | *cis*-chlordane ng/g lipid | *trans*-nonachlor ng/g lipid | *cis*-nonachlor ng/g lipid | Mirex ng/g lipid | Heptachlor epoxide ng/g lipid | Dieldrin ng/g lipid |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | M | 1981 | 4 | 230 | 4.0 | 50 | 310 | 45 | NDR | 53 | 93 |
| 47 | M | 1981 | 4 | 210 | 5.0 | 38 | 240 | 38 | NDR | 54 | 110 |
| Mean | | | | 188 | 7.2 | 69 | 314 | 47 | 12 | 47 | 88 |
| SD | | | | 93 | 5.1 | 67 | 293 | 37 | 13 | 21 | 40 |
| 4 | F | 1991 | 7 | 100 | 3.1 | 33 | 84 | 10 | 3.2 | 29 | 24 |
| 5 | F | 1991 | 7 | 80 | 2.4 | 35 | 96 | 12 | 3.4 | 32 | 52 |
| 8 | F | 1991 | 7 | 61 | 2.1 | 23 | 58 | 8 | 3.4 | 24 | 30 |
| 10 | F | 1991 | 7 | 79 | 4.4 | 78 | 260 | 27 | 10.0 | 33 | 35 |
| 18 | F | 1991 | 7 | 96 | ND | 34 | 45 | 10 | NDR | 37 | 38 |
| 19 | F | 1991 | 7 | 89 | 0.9 | 8 | 52 | 6 | ND | 26 | 43 |
| 25 | F | 1991 | 7 | 110 | NDR | 50 | 56 | 12 | 5.9 | 22 | 37 |
| Mean | | | | 88 | 2.6 | 37 | 93 | 12 | 5 | 29 | 37 |
| SD | | | | 16 | 1.3 | 22 | 76 | 7 | 3 | 5 | 9 |
| 1 | M | 1991 | 8 | 110 | 4.4 | 28 | 28 | 3 | NDR | 29 | 21 |
| 3 | M | 1991 | 8 | 140 | 4.3 | 51 | 96 | 16 | 4.3 | 29 | 46 |
| 11 | M | 1991 | 8 | 93 | 2.4 | 28 | 120 | 11 | NDR | 43 | 21 |
| 13 | M | 1991 | 8 | 260 | 1.7 | 22 | 155 | 16 | NDR | 41 | 51 |
| 14 | M | 1991 | 8 | 280 | 7.2 | 89 | 170 | 23 | 6.2 | 49 | 79 |
| 15 | M | 1991 | 8 | 210 | ND | 75 | 90 | 18 | 5.9 | 36 | 56 |

Cont'd./3

| Sample | Sex | Year sampled | Group | Oxy-chlordane ng/g lipid | *trans*-chlordane ng/g lipid | *cis*-chlordane ng/g lipid | *trans*-nonachlor ng/g lipid | *cis*-nonachlor ng/g lipid | Mirex ng/g lipid | Heptachlor epoxide ng/g lipid | Dieldrin ng/g lipid |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | M | 1991 | 8 | 160 | NDR | 75 | 100 | 27 | 6.0 | 41 | 91 |
| 21 | M | 1991 | 8 | 200 | 1.7 | 85 | NDR | 35 | 6.2 | 57 | 96 |
| 23 | M | 1991 | 8 | 170 | NDR | 66 | 72 | 16 | 6.9 | 37 | 49 |
| 24 | M | 1991 | 8 | 26 | ND | 84 | 96 | 15 | 3.7 | 45 | 92 |
| 28 | M | 1991 | 8 | 210 | NDR | 69 | 75 | 19 | 2.4 | 74 | 103 |
| Mean | | | | 169 | 3.6 | 61 | 100 | 18 | 5.2 | 44 | 64 |
| SD | | | | 75 | 2.1 | 25 | 41 | 8 | 1.6 | 13 | 30 |

ND: Not detected

NDR: Outside acceptable range of ratio of sample:standard stable isotopes

Table 12: Chlorobiphenyl concentrations (ng/g lipid) in blubber of male and female ringed seal (*Phoca hispida*) in 1981 and 1991.

Data from Axys contract files 2894

| Sample no. | Sex | Year | Group | CB #: | 8/5 | 15 | 19 | 18 | 17 | 24/27 | 16/32 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | | ND | ND | ND | 0.7 | ND | ND | ND | ND |
| 19 | F | 1981 | 3 | | ND | ND | ND | ND | ND | ND | ND | ND |
| 27 | F | 1981 | 3 | | NDR | ND | ND | ND | ND | ND | ND | 0.3 |
| 30 | F | 1981 | 3 | | NDR | ND | ND | ND | ND | ND | ND | ND |
| 42 | F | 1981 | 3 | | NDR | ND | ND | ND | ND | ND | ND | 0.6 |
| 50 | F | 1981 | 3 | | NDR | ND | ND | ND | ND | ND | ND | ND |
| 54 | F | 1981 | 3 | | NDR | ND | ND | ND | ND | ND | ND | 0.3 |
| | Mean | | | | | | | 0.7 | | | | 0.4 |
| | SD | | | | | | | | | | | 0.2 |
| 6 | M | 1981 | 4 | | NDR | ND | ND | 4.8 | ND | 0.5 | 1.9 | 1.3 |
| 7 | M | 1981 | 4 | | ND | ND | ND | 0.6 | ND | ND | ND | ND |
| 8 | M | 1981 | 4 | | ND | ND | ND | ND | ND | ND | ND | ND |
| 22 | M | 1981 | 4 | | NDR | ND | ND | 0.5 | ND | ND | 0.3 | 0.3 |
| 28 | M | 1981 | 4 | | ND | ND | ND | ND | ND | ND | ND | ND |
| 29 | M | 1981 | 4 | | NDR | ND | ND | 0.9 | NDR | ND | ND | 0.6 |
| 31 | M | 1981 | 4 | | NDR | ND | ND | ND | ND | ND | ND | 0.9 |
| 41 | M | 1981 | 4 | | NDR | ND | ND | ND | ND | ND | ND | ND |
| 43 | M | 1981 | 4 | | NDR | ND | ND | 2.6 | ND | ND | 0.7 | ND |
| 45 | M | 1981 | 4 | | NDR | ND | ND | 0.7 | ND | ND | ND | ND |

File: AXCB8191.XLS

Cont'd./ 2

| Sample no. | Sex | Year | Group | CB #: | 8/5 | 15 | 19 | 18 | 17 | 24/27 | 16/32 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | | NDR | ND | ND | ND | ND | ND | ND | ND |
| | Mean | | | | | | | 1.7 | | 0.5 | 1.0 | 0.8 |
| | SD | | | | | | | 1.7 | | | 0.8 | 0.4 |
| 4 | F | 1991 | 7 | | ND | ND | ND | 0.1 | ND | ND | ND | 0.1 |
| 6 | F | 1991 | 7 | | ND | ND | ND | 0.1 | ND | ND | ND | 0.1 |
| 8 | F | 1991 | 7 | | ND | ND | ND | 0.2 | ND | ND | ND | 0.1 |
| 10 | F | 1991 | 7 | | NDR | ND | ND | 1.8 | 0.2 | ND | 0.6 | 0.3 |
| 18 | F | 1991 | 7 | | ND | ND | ND | 0.1 | ND | ND | ND | 0.6 |
| 19 | F | 1991 | 7 | | NDR | ND | ND | ND | ND | ND | ND | ND |
| 25 | F | 1991 | 7 | | ND | ND | ND | 0.2 | ND | ND | ND | 0.3 |
| | Mean | | | | | | | 0.4 | 0.2 | | 0.6 | 0.3 |
| | SD | | | | | | | 0.7 | | | | 0.2 |
| 1 | M | 1991 | 8 | | ND | ND | ND | ND | ND | ND | ND | 0.3 |
| 3 | M | 1991 | 8 | | ND | ND | ND | 0.2 | ND | ND | 0.1 | 0.1 |
| 11 | M | 1991 | 8 | | ND | ND | ND | 0.2 | ND | ND | ND | 0.1 |
| 13 | M | 1991 | 8 | | NDR | ND | ND | ND | ND | ND | ND | ND |
| 14 | M | 1991 | 8 | | ND | ND | ND | 0.1 | ND | ND | 0.1 | 0.1 |
| 15 | M | 1991 | 8 | | ND | ND | ND | 0.5 | ND | ND | NDR | 0.3 |
| 17 | M | 1991 | 8 | | ND | ND | ND | ND | ND | ND | ND | 0.2 |

Cont'd./3

| Sample no. | Sex | Year | Group | CB #: | 8/5 | 15 | 19 | 18 | 17 | 24/27 | 16/32 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | | ND | ND | ND | 0.3 | ND | ND | ND | 0.3 |
| 23 | M | 1991 | 8 | | ND | ND | ND | 0.2 | ND | ND | ND | 0.2 |
| 24 | M | 1991 | 8 | | ND | ND | ND | 0.6 | 0.2 | ND | 0.3 | 0.2 |
| 28 | M | 1991 | 8 | | ND | ND | ND | 0.1 | ND | | 0.2 | 0.3 |
| | Mean | | | | | | | 0.3 | 0.2 | | 0.1 | 0.2 |
| | SD | | | | | | | 0.2 | | | 0.1 | 0.1 |

ND: Not detected
NDR: Outside acceptable range of ratio sample:standard stable isotopes

File: AXCB8191.XLS

Cont'd./4

| Sample no. | Sex | Year | Group | 25 | 31/28 | 33 | 22 | 45 | 46 | 52 | 49 | 47/48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | ND | 6.9 | 0.3 | ND | ND | ND | 20.0 | 6.2 | 3.9 |
| 19 | F | 1981 | 3 | ND | 9.1 | ND | ND | ND | ND | 15.5 | 3.8 | 4.2 |
| 27 | F | 1981 | 3 | ND | 14.0 | ND | ND | ND | ND | 18.0 | 3.7 | 4.0 |
| 30 | F | 1981 | 3 | ND | 11.0 | ND | ND | ND | ND | 16.0 | 3.7 | 3.9 |
| 42 | F | 1981 | 3 | ND | 12.0 | ND | ND | ND | ND | 21.0 | 5.1 | 4.0 |
| 50 | F | 1981 | 3 | ND | 11.0 | ND | ND | ND | ND | 15.0 | 3.3 | 5.2 |
| 54 | F | 1981 | 3 | ND | 9.5 | ND | ND | ND | ND | 14.5 | 3.1 | 2.9 |
| | Mean | | | | 10.5 | 0.3 | | | | 17.1 | 4.1 | 4.0 |
| | SD | | | | 2.3 | | | | | 2.6 | 1.1 | 0.7 |
| 6 | M | 1981 | 4 | ND | 31.0 | 1.6 | 0.9 | ND | ND | 76.0 | 22.0 | 19.0 |
| 7 | M | 1981 | 4 | ND | 18.0 | ND | ND | ND | ND | 48.0 | 12.0 | 10.0 |
| 8 | M | 1981 | 4 | ND | 9.2 | ND | ND | ND | ND | 14.0 | 2.9 | 3.7 |
| 22 | M | 1981 | 4 | ND | 21.0 | 0.2 | 0.2 | ND | ND | 52.0 | 11.0 | 12.0 |
| 28 | M | 1981 | 4 | ND | 9.5 | ND | ND | ND | ND | 15.0 | 3.0 | 3.8 |
| 29 | M | 1981 | 4 | ND | 14.0 | 0.7 | ND | ND | ND | 34.0 | 7.2 | 8.5 |
| 31 | M | 1981 | 4 | ND | 17.0 | 0.7 | ND | ND | ND | 36.0 | 8.1 | 10.0 |
| 41 | M | 1981 | 4 | ND | 26.0 | ND | ND | ND | ND | 48.0 | 11.0 | 9.7 |
| 43 | M | 1981 | 4 | ND | 22.0 | ND | ND | ND | ND | 140.0 | 27.0 | 36.0 |
| 45 | M | 1981 | 4 | ND | 20.0 | ND | ND | ND | ND | 61.0 | 14.0 | 12.0 |

Cont'd./5

| Sample no. | Sex | Year | Group | 25 | 31/28 | 33 | 22 | 45 | 46 | 52 | 49 | 47/48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | ND | 24.0 | ND | ND | ND | ND | 58.0 | 13.0 | 12.0 |
| | Mean | | | | 19.2 | 0.8 | 0.5 | | | 52.9 | 11.9 | 12.4 |
| | SD | | | | 6.7 | 0.6 | 0.5 | | | 34.4 | 7.3 | 8.9 |
| 4 | F | 1991 | 7 | ND | 6.5 | 0.1 | ND | ND | ND | 10.0 | 2.2 | 4.1 |
| 6 | F | 1991 | 7 | ND | 6.4 | 0.1 | 0.1 | ND | ND | 13.0 | 2.9 | 2.8 |
| 8 | F | 1991 | 7 | ND | 5.7 | 0.1 | 0.1 | ND | ND | 9.2 | 2.2 | 2.4 |
| 10 | F | 1991 | 7 | ND | 10.0 | 0.5 | 0.2 | 0.1 | ND | 24.0 | 6.4 | 4.9 |
| 18 | F | 1991 | 7 | ND | 1.1 | 0.2 | ND | ND | ND | 13.0 | 2.4 | 3.9 |
| 19 | F | 1991 | 7 | ND | 7.9 | ND | ND | ND | ND | 14.0 | 3.0 | 3.5 |
| 25 | F | 1991 | 7 | ND | 7.5 | 0.2 | 0.1 | ND | ND | 11.0 | 2.5 | 3.0 |
| | Mean | | | | 6.4 | 0.2 | 0.1 | 0.1 | | 13.5 | 3.1 | 3.5 |
| | SD | | | | 2.7 | 0.1 | 0.1 | | | 5.0 | 1.5 | 0.9 |
| 1 | M | 1991 | 8 | ND | 8.6 | 0.1 | 0.1 | ND | ND | 6.2 | 1.3 | 2.8 |
| 3 | M | 1991 | 8 | ND | 8.7 | 0.1 | 0.1 | ND | ND | 19.0 | 4.0 | 5.2 |
| 11 | M | 1991 | 8 | ND | 6.9 | 0.2 | ND | ND | ND | 13.0 | 2.8 | 4.5 |
| 13 | M | 1991 | 8 | ND | ND | ND | ND | ND | ND | 36.5 | 7.5 | 9.0 |
| 14 | M | 1991 | 8 | ND | 11.0 | ND | ND | ND | ND | 35.0 | 7.2 | 9.0 |
| 15 | M | 1991 | 8 | ND | 10.0 | 0.1 | 0.1 | ND | ND | 20.0 | 3.6 | 6.4 |
| 17 | M | 1991 | 8 | ND | 12.0 | 0.2 | ND | ND | ND | 23.0 | 4.7 | 6.6 |

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Cont'd./6

| Sample no. | Sex | Year | Group | 25 | 31/28 | 33 | 22 | 45 | 46 | 52 | 49 | 47/48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | ND | 18.0 | 0.3 | 0.1 | ND | ND | 28.0 | 6.1 | 7.6 |
| 23 | M | 1991 | 8 | ND | 9.2 | 0.1 | ND | ND | ND | 16.0 | 3.1 | 4.8 |
| 24 | M | 1991 | 8 | ND | 14.0 | 0.2 | NDR | ND | ND | 28.0 | 6.6 | 5.9 |
| 28 | M | 1991 | 8 | 0.0 | 24.0 | 0.3 | 0.2 | ND | ND | 28.5 | 6.8 | 7.0 |
| | Mean | | | 0.0 | 12.2 | 0.2 | 0.1 | | | 23.0 | 4.9 | 6.3 |
| | SD | | | | 5.2 | 0.1 | 0.1 | | | 9.3 | 2.1 | 1.9 |

ND: Not detected

NDR: Outside acceptable range of ratio sample:standard stable isotopes

Cont'd./7

| Sample no. | Sex | Year | Group | 44 | 42 | 41/71/6 | 40 | 74 | 70/76 | 66 | 56/60 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | 3.6 | ND | 2.7 | ND | 10.0 | 6.5 | 4.0 | 1.5 | 9.5 |
| 19 | F | 1981 | 3 | 2.4 | NDR | 2.1 | ND | 22.0 | 7.0 | 9.0 | 3.5 | 4.6 |
| 27 | F | 1981 | 3 | 2.4 | ND | 1.7 | ND | 26.0 | 8.7 | 8.5 | 3.8 | 4.7 |
| 30 | F | 1981 | 3 | 1.9 | ND | 1.0 | ND | 27.0 | 4.3 | 6.1 | 3.0 | 6.0 |
| 42 | F | 1981 | 3 | 3.9 | ND | 4.3 | ND | 18.0 | 9.2 | 8.8 | 3.2 | 7.8 |
| 50 | F | 1981 | 3 | 1.8 | ND | 1.0 | ND | 33.0 | 5.7 | 5.8 | 3.5 | 4.3 |
| 54 | F | 1981 | 3 | 2.4 | ND | 1.3 | ND | 13.5 | 8.9 | 7.3 | 2.7 | 6.7 |
| | Mean | | | 2.6 | | 2.0 | | 21.4 | 7.2 | 7.1 | 3.0 | 6.2 |
| | SD | | | 0.8 | | 1.2 | | 8.1 | 1.8 | 1.9 | 0.8 | 1.9 |
| 6 | M | 1981 | 4 | 10.0 | NDR | 14.0 | 0.6 | 49.0 | 18.0 | 33.0 | 9.1 | 31.0 |
| 7 | M | 1981 | 4 | 6.0 | 0.7 | 3.9 | ND | 39.0 | 9.1 | 6.1 | 3.0 | 15.0 |
| 8 | M | 1981 | 4 | 1.4 | NDR | 1.3 | ND | 22.0 | 5.9 | 4.8 | 2.3 | 2.8 |
| 22 | M | 1981 | 4 | 4.6 | 0.8 | 4.8 | ND | 42.0 | 5.8 | 9.7 | 5.6 | 12.0 |
| 28 | M | 1981 | 4 | 2.0 | ND | 1.4 | ND | 21.0 | 6.0 | 5.8 | 3.0 | 4.5 |
| 29 | M | 1981 | 4 | 4.1 | 0.7 | 5.2 | ND | 27.0 | 8.1 | 13.0 | 5.0 | 9.8 |
| 31 | M | 1981 | 4 | 3.8 | ND | 3.6 | ND | 36.0 | 7.9 | 21.0 | 7.1 | 11.0 |
| 41 | M | 1981 | 4 | 6.5 | ND | 4.9 | ND | 57.0 | 8.6 | 12.0 | 6.6 | 15.0 |
| 43 | M | 1981 | 4 | 7.5 | ND | 7.1 | ND | 93.0 | 6.2 | 8.8 | 6.8 | 50.0 |
| 45 | M | 1981 | 4 | 6.1 | 0.9 | 5.8 | ND | 51.0 | 7.0 | 8.7 | 5.2 | 20.0 |

File: AXCB8191.XLS

Cont'd./8

| Sample no. | Sex | Year | Group | 44 | 42 | 41/71/6 | 40 | 74 | 70/76 | 66 | 56/60 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | 7.2 | ND | 4.9 | ND | 62.0 | 9.4 | 10.0 | 6.6 | 21.0 |
| | Mean | | | 5.4 | 0.8 | 5.2 | 0.6 | 45.4 | 8.4 | 12.1 | 5.5 | 17.5 |
| | SD | | | 2.5 | 0.1 | 3.4 | | 20.8 | 3.5 | 8.2 | 2.1 | 13.4 |
| 4 | F | 1991 | 7 | 0.9 | 0.1 | 0.7 | 0.0 | 22.0 | 3.3 | 3.9 | 2.2 | 2.4 |
| 6 | F | 1991 | 7 | 1.4 | ND | 1.0 | ND | 11.0 | 4.0 | 2.6 | 1.3 | 3.4 |
| 8 | F | 1991 | 7 | 1.0 | 0.1 | 0.9 | ND | 10.0 | 3.5 | 2.4 | 1.2 | 2.3 |
| 10 | F | 1991 | 7 | 3.4 | 1.1 | 3.6 | 0.2 | 11.0 | 7.0 | 4.7 | 1.8 | 10.0 |
| 18 | F | 1991 | 7 | 1.0 | 0.2 | 1.0 | ND | 20.0 | 7.5 | 12.0 | 3.3 | 3.3 |
| 19 | F | 1991 | 7 | 1.4 | ND | 1.0 | ND | 16.0 | 2.1 | 2.3 | 1.3 | 3.1 |
| 25 | F | 1991 | 7 | 1.6 | 0.2 | 1.1 | ND | 15.0 | 4.7 | 3.7 | 1.7 | 4.0 |
| | Mean | | | 1.5 | 0.3 | 1.3 | 0.1 | 15.0 | 4.6 | 4.5 | 1.8 | 4.1 |
| | SD | | | 0.9 | 0.4 | 1.0 | 0.1 | 4.7 | 2.0 | 3.4 | 0.7 | 2.7 |
| 1 | M | 1991 | 8 | 0.6 | NDR | 1.1 | 0.0 | 28.0 | 3.4 | 17.0 | 4.9 | 1.0 |
| 3 | M | 1991 | 8 | 2.3 | 0.3 | 1.3 | 0.1 | 25.0 | 3.6 | 2.9 | 1.8 | 5.0 |
| 11 | M | 1991 | 8 | 1.1 | 0.1 | 0.6 | ND | 15.0 | 3.0 | 3.2 | 1.7 | 3.6 |
| 13 | M | 1991 | 8 | 3.6 | ND | 3.3 | ND | 47.0 | 6.2 | 11.5 | 5.6 | 9.2 |
| 14 | M | 1991 | 8 | 2.4 | 0.3 | 1.4 | ND | 33.0 | 3.5 | 3.0 | 2.1 | 6.6 |
| 15 | M | 1991 | 8 | 1.8 | NDR | 1.7 | 0.1 | 36.0 | 3.8 | 21.0 | 5.6 | 4.2 |
| 17 | M | 1991 | 8 | 2.0 | 0.2 | 1.2 | ND | 26.0 | 6.4 | 5.0 | 2.4 | 5.1 |

Cont'd./9

| Sample no. | Sex | Year | Group | 44 | 42 | 41/71/6 | 40 | 74 | 70/76 | 66 | 56/60 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | 2.5 | 0.3 | 2.2 | ND | 34.0 | 12.0 | 8.7 | 3.9 | 7.1 |
| 23 | M | 1991 | 8 | 1.6 | ND | 0.8 | ND | 27.0 | 5.3 | 3.5 | 2.1 | 4.6 |
| 24 | M | 1991 | 8 | 3.6 | 0.7 | 2.9 | 0.2 | 25.0 | 5.6 | 4.8 | 2.4 | 9.4 |
| 28 | M | 1991 | 8 | 3.2 | 0.5 | 2.9 | 0.2 | 36.5 | 8.7 | 8.5 | 4.0 | 6.8 |
| | Mean | | | 2.2 | 0.3 | 1.8 | 0.1 | 30.2 | 5.6 | 8.1 | 3.3 | 5.7 |
| | SD | | | 1.0 | 0.2 | 0.9 | 0.1 | 8.3 | 2.7 | 6.1 | 1.5 | 2.5 |

ND: Not detected

NDR: Outside acceptable range of ratio sample:standard stable isotopes

File: AXCB8191.XLS

Cont'd./10

| Sample no. | Sex | Year | Group | 91 | 84/89 | 90/101 | 99 | 83 | 97 | 87 | 85 | 110 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | 1.1 | 4.6 | 28.0 | 18.0 | ND | 1.7 | 9.6 | 6.6 | 13.0 |
| 19 | F | 1981 | 3 | 0.3 | 5.8 | 36.0 | 24.0 | ND | 1.0 | 9.5 | 4.9 | 10.6 |
| 27 | F | 1981 | 3 | 0.5 | 6.2 | 49.0 | 34.0 | ND | 1.1 | 11.0 | 3.9 | 16.0 |
| 30 | F | 1981 | 3 | 0.8 | 8.6 | 51.0 | 39.0 | ND | 1.1 | 11.0 | 4.6 | 13.0 |
| 42 | F | 1981 | 3 | 1.1 | 7.7 | 52.0 | 33.0 | ND | 1.5 | 12.0 | 4.3 | 18.0 |
| 50 | F | 1981 | 3 | 0.7 | 6.4 | 45.0 | 49.0 | ND | ND | 7.1 | 5.8 | 12.0 |
| 54 | F | 1981 | 3 | 0.7 | 9.0 | 31.0 | 20.5 | ND | 0.5 | 10.3 | 4.1 | 14.0 |
| | Mean | | | 0.7 | 6.9 | 41.7 | 31.1 | | 1.1 | 10.1 | 4.9 | 13.8 |
| | SD | | | 0.3 | 1.6 | 9.9 | 11.0 | | 0.4 | 1.6 | 1.0 | 2.5 |
| 6 | M | 1981 | 4 | 4.9 | 15.0 | 110.0 | 63.0 | ND | 5.0 | 39.0 | 24.0 | 47.0 |
| 7 | M | 1981 | 4 | 2.0 | 9.0 | 72.0 | 52.0 | ND | 2.9 | 18.0 | 10.0 | 19.0 |
| 8 | M | 1981 | 4 | 0.3 | 4.2 | 27.0 | 21.0 | ND | 0.9 | 6.4 | 4.6 | 8.5 |
| 22 | M | 1981 | 4 | 2.1 | 17.0 | 100.0 | 74.0 | ND | 1.9 | 22.0 | 14.0 | 24.0 |
| 28 | M | 1981 | 4 | 0.7 | 6.5 | 42.0 | 34.0 | ND | 1.2 | 10.0 | 4.6 | 14.0 |
| 29 | M | 1981 | 4 | 1.5 | 12.0 | 64.0 | 46.0 | ND | 1.6 | 18.0 | 12.0 | 22.0 |
| 31 | M | 1981 | 4 | 1.9 | 16.0 | 86.0 | 62.0 | ND | 1.6 | 24.0 | 16.0 | 28.0 |
| 41 | M | 1981 | 4 | 1.7 | 14.0 | 100.0 | 73.0 | ND | 2.8 | 20.0 | 8.3 | 28.0 |
| 43 | M | 1981 | 4 | 8.4 | 38.0 | 230.0 | 190.0 | ND | 3.2 | 32.0 | 50.0 | 31.0 |
| 45 | M | 1981 | 4 | 3.1 | 16.0 | 120.0 | 84.0 | ND | 2.9 | 23.0 | 14.0 | 27.0 |

ont'd./ 11

| Sample no. | Sex | Year | Group | 91 | 84/89 | 90/101 | 99 | 83 | 97 | 87 | 85 | 110 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | 2.5 | 21.0 | 140.0 | 100.0 | ND | 3.3 | 28.0 | 13.0 | 34.0 |
| | Mean | | | 2.6 | 15.3 | 99.2 | 72.6 | | 2.5 | 21.9 | 15.5 | 25.7 |
| | SD | | | 2.3 | 9.0 | 54.7 | 44.9 | | 1.2 | 9.2 | 12.7 | 10.3 |
| 4 | F | 1991 | 7 | 0.4 | 5.6 | 40.0 | 43.0 | 0.1 | 0.6 | 10.0 | 8.3 | 11.0 |
| 6 | F | 1991 | 7 | 0.4 | 3.6 | 27.0 | 21.0 | 0.1 | 0.8 | 7.4 | 5.0 | 10.0 |
| 8 | F | 1991 | 7 | 0.4 | 2.7 | 21.0 | 19.0 | 0.1 | 0.6 | 5.7 | 4.0 | 7.5 |
| 10 | F | 1991 | 7 | 1.2 | 5.0 | 37.0 | 24.0 | NDR | 1.4 | 12.0 | 8.6 | 18.0 |
| 18 | F | 1991 | 7 | 0.4 | 6.2 | 37.0 | 29.0 | ND | 0.6 | 11.0 | 5.6 | 12.0 |
| 19 | F | 1991 | 7 | 0.4 | 3.8 | 29.0 | 23.0 | ND | 0.5 | 5.5 | 3.1 | 7.3 |
| 25 | F | 1991 | 7 | NDR | 5.2 | 31.0 | 28.0 | ND | 1.1 | 7.7 | 4.4 | 7.7 |
| | Mean | | | 0.5 | 4.6 | 31.7 | 26.7 | 0.1 | 0.8 | 8.5 | 5.6 | 10.5 |
| | SD | | | 0.3 | 1.2 | 6.7 | 8.0 | 0.0 | 0.3 | 2.6 | 2.1 | 3.8 |
| 1 | M | 1991 | 8 | 0.2 | 4.0 | 36.0 | 40.0 | ND | 0.3 | 9.7 | 3.7 | 8.1 |
| 3 | M | 1991 | 8 | 0.7 | 5.7 | 43.0 | 47.0 | 0.2 | 1.6 | 9.5 | 7.3 | 11.0 |
| 11 | M | 1991 | 8 | 0.6 | 3.8 | 31.0 | 25.0 | 0.1 | 0.9 | 8.8 | 9.0 | 11.0 |
| 13 | M | 1991 | 8 | 1.2 | 16.0 | 100.0 | 89.0 | ND | 1.6 | 22.5 | 8.6 | 25.5 |
| 14 | M | 1991 | 8 | 1.1 | 7.5 | 67.0 | 71.0 | 0.2 | 1.6 | 12.0 | 11.0 | 14.0 |
| 15 | M | 1991 | 8 | 0.5 | 8.4 | 56.0 | 61.0 | ND | 0.8 | 16.0 | 7.5 | 17.0 |
| 17 | M | 1991 | 8 | 1.0 | 7.1 | 48.0 | 45.0 | ND | 1.2 | 10.0 | 9.2 | 11.0 |

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Cont'd./12

| Sample no. | Sex | Year | Group | 91 | 84/89 | 90/101 | 99 | 83 | 97 | 87 | 85 | 110 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | 1.2 | 8.6 | 61.0 | 48.0 | ND | 1.3 | 16.0 | 10.0 | 19.0 |
| 23 | M | 1991 | 8 | 0.6 | 7.1 | 52.0 | 49.0 | ND | 1.2 | 11.0 | 8.2 | 10.0 |
| 24 | M | 1991 | 8 | 1.2 | 7.4 | 53.0 | 40.0 | ND | 3.0 | 12.0 | 7.8 | 16.0 |
| 28 | M | 1991 | 8 | 0.9 | 9.6 | 71.5 | 51.0 | ND | 2.1 | 15.5 | 8.8 | 21.0 |
| | Mean | | | 0.8 | 7.7 | 56.2 | 51.5 | 0.2 | 1.4 | 13.0 | 8.3 | 14.9 |
| | SD | | | 0.3 | 3.3 | 19.0 | 17.1 | 0.1 | 0.7 | 4.1 | 1.9 | 5.4 |

ND: Not detected
NDR: Outside acceptable range of ratio sample:standard stable isotopes

Cont'd./13

| Sample no. | Sex | Year | Group | 107 | 118 | 114 | 105 | 136 | 151 | 144/13 | 149 | 134 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | NDR | 14.0 | ND | 4.3 | 1.4 | 11.0 | 4.1 | 20.0 | 1.0 |
| 19 | F | 1981 | 3 | 1.5 | 32.0 | ND | 11.0 | 1.1 | 3.4 | 2.1 | 13.5 | 0.9 |
| 27 | F | 1981 | 3 | 3.5 | 29.0 | 0.9 | 9.2 | ND | 2.5 | 1.6 | 15.0 | 0.8 |
| 30 | F | 1981 | 3 | 1.6 | 29.0 | 1.1 | 8.7 | ND | 4.4 | 2.5 | 21.0 | 1.6 |
| 42 | F | 1981 | 3 | 5.1 | 31.0 | ND | 8.1 | ND | 4.0 | 2.6 | 21.0 | 1.4 |
| 50 | F | 1981 | 3 | 0.9 | 36.0 | 1.1 | 11.0 | ND | 3.7 | 1.3 | 11.0 | 1.0 |
| 54 | F | 1981 | 3 | 3.0 | 17.0 | ND | 4.7 | ND | 6.4 | 2.0 | 18.5 | ND |
| | Mean | | | 2.6 | 26.9 | 1.0 | 8.1 | 1.2 | 5.1 | 2.3 | 17.1 | 1.1 |
| | SD | | | 1.6 | 8.2 | 0.1 | 2.7 | 0.2 | 2.9 | 0.9 | 4.0 | 0.3 |
| 6 | M | 1981 | 4 | 4.8 | 68.0 | ND | 20.0 | 3.1 | 32.0 | 9.7 | 39.0 | 2.0 |
| 7 | M | 1981 | 4 | 0.8 | 36.0 | ND | 14.0 | 2.0 | 9.1 | 5.1 | 37.0 | 1.7 |
| 8 | M | 1981 | 4 | 0.6 | 22.0 | ND | 7.7 | 0.9 | 2.2 | 1.3 | 9.1 | 0.9 |
| 22 | M | 1981 | 4 | 2.0 | 55.0 | 2.1 | 18.0 | 0.5 | 12.0 | 4.7 | 36.0 | ND |
| 28 | M | 1981 | 4 | 0.9 | 28.0 | 1.0 | 8.9 | ND | 3.1 | 1.8 | 15.0 | ND |
| 29 | M | 1981 | 4 | 1.2 | 42.0 | 1.2 | 12.0 | 0.5 | 10.0 | 3.4 | 22.0 | ND |
| 31 | M | 1981 | 4 | 3.5 | 56.0 | 1.5 | 16.0 | ND | 12.0 | 3.9 | 26.0 | 1.4 |
| 41 | M | 1981 | 4 | 2.2 | 61.0 | 1.9 | 18.0 | 0.8 | 6.8 | 3.9 | 37.0 | 2.1 |
| 43 | M | 1981 | 4 | 4.7 | 78.0 | 3.3 | 28.0 | 2.1 | 51.0 | 20.0 | 94.0 | 6.2 |
| 45 | M | 1981 | 4 | 2.1 | 60.0 | 1.6 | 17.0 | 1.0 | 14.0 | 5.0 | 39.0 | 2.0 |

File: AXCB8191.XLS

Cont'd./14

| Sample no. | Sex | Year | Group | 107 | 118 | 114 | 105 | 136 | 151 | 144/13 | 149 | 134 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | 4.8 | 78.0 | 2.7 | 24.0 | 0.9 | 12.0 | 6.5 | 58.0 | 3.3 |
| | Mean | | | 2.5 | 53.1 | 1.9 | 16.7 | 1.3 | 14.9 | 5.9 | 37.5 | 2.5 |
| | SD | | | 1.7 | 19.0 | 0.8 | 6.1 | 0.9 | 14.3 | 5.2 | 23.0 | 1.7 |
| 4 | F | 1991 | 7 | 1.1 | 33.0 | 0.6 | 12.0 | 0.1 | 3.1 | 1.4 | 10.0 | 1.3 |
| 6 | F | 1991 | 7 | 0.8 | 16.0 | 0.3 | 5.5 | 0.2 | 2.9 | 1.5 | 11.0 | 0.8 |
| 8 | F | 1991 | 7 | 0.7 | 15.0 | 0.3 | 5.1 | 0.1 | 2.2 | 1.0 | 7.9 | 0.7 |
| 10 | F | 1991 | 7 | 1.3 | 22.0 | 0.4 | 6.6 | 0.9 | 14.0 | 4.3 | 20.0 | 1.2 |
| 18 | F | 1991 | 7 | 2.7 | 36.0 | 0.6 | 11.0 | NDR | 2.4 | 0.2 | 14.0 | 1.2 |
| 19 | F | 1991 | 7 | 1.0 | 18.0 | 0.5 | 5.5 | ND | 1.3 | 0.8 | 7.7 | 0.5 |
| 25 | F | 1991 | 7 | 1.3 | 22.0 | NDR | 7.9 | NDR | 2.7 | 1.5 | 12.0 | 1.6 |
| | Mean | | | 1.3 | 23.1 | 0.5 | 7.7 | 0.3 | 4.1 | 1.5 | 11.8 | 1.1 |
| | SD | | | 0.7 | 8.3 | 0.1 | 2.8 | 0.4 | 4.4 | 1.3 | 4.2 | 0.4 |
| 1 | M | 1991 | 8 | 3.0 | 57.0 | 0.8 | 17.0 | 0.1 | 0.7 | 0.5 | 6.0 | 1.4 |
| 3 | M | 1991 | 8 | 0.8 | 28.0 | 0.6 | 11.0 | 0.3 | 3.4 | 1.8 | 16.0 | 1.7 |
| 11 | M | 1991 | 8 | 0.9 | 19.0 | 0.4 | 6.8 | 0.2 | 4.6 | 1.6 | 8.7 | 0.7 |
| 13 | M | 1991 | 8 | 5.8 | 80.5 | 2.6 | 22.5 | ND | 4.8 | 3.0 | 29.5 | ND |
| 14 | M | 1991 | 8 | 1.0 | 32.0 | 0.8 | 12.0 | 0.3 | 4.6 | 2.6 | 25.0 | 2.6 |
| 15 | M | 1991 | 8 | 4.2 | 79.0 | 1.4 | 26.0 | ND | 2.4 | 1.3 | 14.0 | 2.6 |
| 17 | M | 1991 | 8 | 1.4 | 34.0 | 0.7 | 12.0 | NDR | 4.8 | 2.0 | 15.0 | 1.7 |

Cont'd./15

| Sample no. | Sex | Year | Group | 107 | 118 | 114 | 105 | 136 | 151 | 144/13 | 149 | 134 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | 2.4 | 48.0 | 1.1 | 16.0 | NDR | 6.4 | 2.7 | 19.0 | 1.7 |
| 23 | M | 1991 | 8 | 1.2 | 34.0 | 1.0 | 13.0 | NDR | 3.6 | 2.0 | 17.0 | 2.4 |
| 24 | M | 1991 | 8 | 1.4 | 31.0 | 0.7 | 12.0 | NDR | 5.0 | 3.0 | 23.0 | 1.8 |
| 28 | M | 1991 | 8 | 2.2 | 48.5 | 1.0 | 16.5 | NDR | 3.5 | 2.7 | 23.5 | 1.9 |
| | Mean | | | 2.2 | 44.6 | 1.0 | 15.0 | 0.2 | 4.0 | 2.1 | 17.9 | 1.8 |
| | SD | | | 1.6 | 20.4 | 0.6 | 5.5 | 0.1 | 1.5 | 0.8 | 7.1 | 0.6 |

ND: Not detected
NDR: Outside acceptable range of ratio sample:standard stable isotopes



File: AXCB8191.XLS

Cont'd./16

| Sample no. | Sex | Year | Group | 131 | 146 | 153 | 141 | 130 | 137 | 38/163/16 | 158 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | ND | 5.5 | 57.0 | 3.2 | ND | 2.5 | 48.0 | 2.8 |
| 19 | F | 1981 | 3 | ND | 5.9 | 63.0 | 3.7 | ND | 3.3 | 52.0 | 2.7 |
| 27 | F | 1981 | 3 | ND | 5.3 | 65.0 | 2.9 | ND | 2.3 | 50.0 | 2.5 |
| 30 | F | 1981 | 3 | ND | 8.0 | 92.0 | 2.8 | ND | 3.5 | 72.0 | 3.7 |
| 42 | F | 1981 | 3 | ND | 8.4 | 96.0 | 5.2 | ND | 3.8 | 73.0 | 3.8 |
| 50 | F | 1981 | 3 | ND | 7.6 | 91.0 | 2.6 | ND | 3.6 | 76.0 | 3.8 |
| 54 | F | 1981 | 3 | ND | 5.8 | 47.0 | 3.7 | ND | 1.9 | 43.0 | ND |
| | Mean | | | | 6.6 | 73.0 | 3.4 | | 3.0 | 59.1 | 3.2 |
| | SD | | | | 1.3 | 19.6 | 0.9 | | 0.8 | 13.9 | 0.6 |
| 6 | M | 1981 | 4 | ND | 14.0 | 150.0 | 12.0 | ND | 5.9 | 140.0 | 8.0 |
| 7 | M | 1981 | 4 | ND | 13.0 | 150.0 | 4.9 | ND | 6.0 | 120.0 | 4.8 |
| 8 | M | 1981 | 4 | ND | 5.4 | 58.0 | 2.4 | ND | 2.7 | 48.0 | 2.0 |
| 22 | M | 1981 | 4 | ND | 15.0 | 140.0 | 6.4 | ND | 6.0 | 120.0 | 7.1 |
| 28 | M | 1981 | 4 | ND | 6.4 | 72.0 | 2.8 | ND | 2.7 | 56.0 | 2.8 |
| 29 | M | 1981 | 4 | ND | 7.4 | 82.0 | 5.3 | ND | 3.1 | 74.0 | 4.5 |
| 31 | M | 1981 | 4 | ND | 9.5 | 100.0 | 8.1 | ND | 3.7 | 99.0 | 6.4 |
| 41 | M | 1981 | 4 | ND | 13.0 | 150.0 | 5.8 | ND | 6.2 | 120.0 | 5.8 |
| 43 | M | 1981 | 4 | ND | 37.0 | 360.0 | 7.0 | ND | 16.0 | 340.0 | 23.0 |
| 45 | M | 1981 | 4 | ND | 16.0 | 160.0 | 6.6 | ND | 6.8 | 140.0 | 9.2 |

Cont'd./17

| Sample no. | Sex | Year | Group | 131 | 146 | 153 | 141 | 130 | 137 | 38/163/16 | 158 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | ND | 22.0 | 210.0 | 8.6 | ND | 9.1 | 180.0 | 11.0 |
| | Mean | | | | 14.4 | 148.4 | 6.4 | | 6.2 | 130.6 | 7.7 |
| | SD | | | | 8.9 | 83.4 | 2.7 | | 3.8 | 79.6 | 5.7 |
| 4 | F | 1991 | 7 | ND | 12.0 | 96.0 | 2.3 | ND | 3.7 | 78.0 | 3.2 |
| 6 | F | 1991 | 7 | ND | 7.4 | 52.0 | 1.6 | ND | 2.1 | 43.0 | 2.1 |
| 8 | F | 1991 | 7 | ND | 7.3 | 52.0 | 1.4 | ND | 2.2 | 43.0 | 1.9 |
| 10 | F | 1991 | 7 | ND | 11.0 | 77.0 | 3.8 | ND | 3.1 | 67.0 | 3.7 |
| 18 | F | 1991 | 7 | ND | 8.6 | 94.0 | 4.3 | ND | 3.7 | 72.0 | 2.7 |
| 19 | F | 1991 | 7 | ND | 4.1 | 50.0 | 1.2 | ND | 1.5 | 38.0 | 1.5 |
| 25 | F | 1991 | 7 | ND | 9.7 | 110.0 | 2.8 | ND | 4.7 | 81.0 | 3.4 |
| | Mean | | | | 8.6 | 75.9 | 2.5 | | 3.0 | 60.3 | 2.6 |
| | SD | | | | 2.6 | 24.9 | 1.2 | | 1.1 | 18.3 | 0.8 |
| 1 | M | 1991 | 8 | ND | 11.0 | 92.0 | 2.4 | ND | 3.8 | 63.0 | 1.8 |
| 3 | M | 1991 | 8 | ND | 14.0 | 110.0 | 1.8 | ND | 4.4 | 85.0 | 3.0 |
| 11 | M | 1991 | 8 | ND | 6.7 | 49.0 | 1.6 | ND | 2.0 | 46.0 | 2.4 |
| 13 | M | 1991 | 8 | ND | 17.0 | 220.0 | 6.7 | ND | 8.2 | 160.0 | 9.5 |
| 14 | M | 1991 | 8 | ND | 23.0 | 180.0 | 2.0 | ND | 7.2 | 140.0 | 4.8 |
| 15 | M | 1991 | 8 | ND | 17.0 | 210.0 | 5.4 | ND | 8.4 | 130.0 | 4.3 |
| 17 | M | 1991 | 8 | ND | 12.0 | 130.0 | 3.3 | ND | 5.6 | 110.0 | 4.8 |

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Cont'd./18

| Sample no. | Sex | Year | Group | 131 | 146 | 153 | 141 | 130 | 137 | 38/163/16 | 158 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | ND | 12.0 | 140.0 | 5.0 | ND | 6.6 | 120.0 | 5.6 |
| 23 | M | 1991 | 8 | ND | 13.0 | 170.0 | 3.5 | ND | 6.7 | 130.0 | 4.6 |
| 24 | M | 1991 | 8 | ND | 9.5 | 110.0 | 3.2 | ND | 4.6 | 86.0 | 3.1 |
| 28 | M | 1991 | 8 | ND | 11.0 | 145.0 | 4.7 | ND | 5.6 | 105.0 | 4.1 |
| | Mean | | | | 13.3 | 141.5 | 3.6 | | 5.7 | 106.8 | 4.4 |
| | SD | | | | 4.4 | 51.3 | 1.7 | | 1.9 | 34.2 | 2.0 |

ND: Not detected
NDR: Outside acceptable range of ratio sample:standard stable isotopes

Cont'd./19

| Sample no. | Sex | Year | Group | 129 | 128 | 156 | 157 | 179 | 176 | 178 | 175 | 187/18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | ND | 5.0 | 1.8 | NDR | ND | ND | 2.5 | 0.6 | 15.0 |
| 19 | F | 1981 | 3 | ND | 3.8 | 2.0 | 0.7 | ND | ND | 2.0 | ND | 6.8 |
| 27 | F | 1981 | 3 | ND | 2.0 | 1.6 | ND | ND | ND | 1.8 | ND | 7.1 |
| 30 | F | 1981 | 3 | ND | 2.2 | 2.9 | ND | ND | ND | 4.4 | ND | 16.0 |
| 42 | F | 1981 | 3 | ND | 2.9 | 2.9 | ND | ND | ND | 5.0 | ND | 18.0 |
| 50 | F | 1981 | 3 | ND | 3.4 | 2.2 | ND | ND | ND | 2.3 | ND | 10.0 |
| 54 | F | 1981 | 3 | ND | 3.5 | 1.3 | ND | ND | ND | 2.6 | ND | 14.0 |
| | Mean | | | | 3.3 | 2.1 | 0.7 | | | 2.9 | 0.6 | 12.4 |
| | SD | | | | 1.0 | 0.6 | | | | 1.2 | | 4.5 |
| 6 | M | 1981 | 4 | ND | 17.0 | 4.5 | 1.4 | 2.1 | 0.3 | 5.2 | 0.9 | 28.0 |
| 7 | M | 1981 | 4 | ND | 6.6 | 4.0 | 1.2 | ND | ND | 4.2 | ND | 19.0 |
| 8 | M | 1981 | 4 | ND | 2.6 | 1.8 | 0.4 | ND | ND | 1.8 | ND | 5.7 |
| 22 | M | 1981 | 4 | 0.7 | 8.3 | 4.5 | 1.2 | 0.2 | ND | 6.4 | 0.3 | 28.0 |
| 28 | M | 1981 | 4 | ND | 2.7 | 2.8 | ND | ND | ND | 2.6 | ND | 9.2 |
| 29 | M | 1981 | 4 | ND | 7.0 | 2.7 | 0.6 | ND | ND | 3.0 | ND | 14.0 |
| 31 | M | 1981 | 4 | ND | 12.0 | 3.7 | ND | ND | ND | 3.4 | ND | 20.0 |
| 41 | M | 1981 | 4 | ND | 4.8 | 4.4 | ND | ND | ND | 5.2 | ND | 19.0 |
| 43 | M | 1981 | 4 | 2.1 | 42.0 | 8.6 | 3.0 | 4.6 | ND | 16.0 | 2.2 | 91.0 |
| 45 | M | 1981 | 4 | ND | 8.2 | 4.1 | ND | ND | ND | 5.8 | ND | 31.0 |

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Cont'd./20

| Sample no. | Sex | Year | Group | 129 | 128 | 156 | 157 | 179 | 176 | 178 | 175 | 187/18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | 1.2 | 8.6 | 6.2 | 1.3 | ND | ND | 9.0 | ND | 36.0 |
| | Mean | | | 1.3 | 10.9 | 4.3 | 1.3 | 2.3 | 0.3 | 5.7 | 1.1 | 27.4 |
| | SD | | | 0.7 | 11.1 | 1.8 | 0.8 | 2.2 | | 4.0 | 1.0 | 23.0 |
| 4 | F | 1991 | 7 | 0.1 | 3.7 | 2.6 | 0.9 | NDR | NDR | 3.0 | 0.1 | 12.0 |
| 6 | F | 1991 | 7 | 0.1 | 2.5 | 1.6 | 0.5 | 0.0 | NDR | 1.8 | NDR | 8.5 |
| 8 | F | 1991 | 7 | NDR | 2.0 | 1.6 | 0.5 | ND | NDR | 1.6 | 0.1 | 7.4 |
| 10 | F | 1991 | 7 | NDR | 7.1 | 2.7 | 0.7 | 1.3 | 0.3 | 3.9 | 0.6 | 24.0 |
| 18 | F | 1991 | 7 | ND | 2.8 | 2.7 | 0.9 | ND | ND | 3.7 | ND | 15.0 |
| 19 | F | 1991 | 7 | ND | 1.5 | 1.0 | ND | ND | ND | 1.2 | ND | 4.7 |
| 25 | F | 1991 | 7 | ND | 2.8 | 3.4 | 0.9 | ND | ND | 5.4 | ND | 15.0 |
| | Mean | | | 0.1 | 3.2 | 2.2 | 0.7 | 0.7 | 0.3 | 2.9 | 0.3 | 12.4 |
| | SD | | | 0.0 | 1.9 | 0.8 | 0.2 | 0.9 | | 1.5 | 0.3 | 6.4 |
| 1 | M | 1991 | 8 | ND | 2.1 | 2.5 | 1.0 | 0.1 | ND | 2.4 | ND | 5.5 |
| 3 | M | 1991 | 8 | 0.1 | 2.8 | 3.1 | 1.0 | 0.1 | NDR | 3.4 | 0.1 | 12.0 |
| 11 | M | 1991 | 8 | ND | 4.6 | 1.6 | 0.5 | 0.1 | 0.1 | 1.2 | 0.1 | 6.9 |
| 13 | M | 1991 | 8 | 0.7 | 5.9 | 6.5 | 1.8 | ND | ND | 8.3 | ND | 25.5 |
| 14 | M | 1991 | 8 | 0.2 | 5.0 | 4.8 | 1.5 | 0.1 | NDR | 4.8 | 0.2 | 17.0 |
| 15 | M | 1991 | 8 | ND | 3.7 | 5.3 | 1.7 | ND | 0.2 | 5.5 | ND | 15.0 |
| 17 | M | 1991 | 8 | ND | 5.6 | 3.6 | 1.2 | ND | ND | 4.0 | ND | 18.0 |

Cont'd./21

| Sample no. | Sex | Year | Group | 129 | 128 | 156 | 157 | 179 | 176 | 178 | 175 | 187/18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | ND | 6.5 | 4.4 | 1.2 | ND | 0.3 | 4.1 | 0.3 | 18.0 |
| 23 | M | 1991 | 8 | ND | 4.0 | 4.5 | 1.3 | ND | ND | 5.3 | ND | 19.0 |
| 24 | M | 1991 | 8 | ND | 4.1 | 3.1 | 0.9 | 0.3 | ND | 3.1 | ND | 12.0 |
| 28 | M | 1991 | 8 | ND | 4.6 | 3.7 | 1.3 | ND | ND | 4.2 | ND | 14.5 |
| | Mean | | | 0.3 | 4.4 | 3.9 | 1.2 | 0.1 | 0.2 | 4.2 | 0.2 | 14.9 |
| | SD | | | 0.3 | 1.3 | 1.4 | 0.4 | 0.1 | 0.1 | 1.8 | 0.1 | 5.7 |

ND: Not detected

NDR: Outside acceptable range of ratio sample:standard stable isotopes

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Cont'd./22

| Sample no. | Sex | Year | Group | 183 | 185 | 174 | 177 | 171 | 172 | 180 | 193 | 191 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | 6.7 | NDR | 2.4 | 2.9 | 1.1 | 1.0 | 13.0 | 0.7 | 0.2 |
| 19 | F | 1981 | 3 | 4.5 | ND | 1.6 | 0.9 | 0.4 | 0.7 | 8.9 | 0.6 | ND |
| 27 | F | 1981 | 3 | 3.9 | ND | 0.9 | ND | 0.5 | 0.5 | 9.0 | 0.5 | ND |
| 30 | F | 1981 | 3 | 8.5 | ND | 1.8 | ND | ND | 1.3 | 22.0 | 1.5 | ND |
| 42 | F | 1981 | 3 | 10.0 | ND | 1.5 | 1.0 | 1.1 | 1.6 | 24.0 | 1.4 | ND |
| 50 | F | 1981 | 3 | 5.8 | ND | ND | ND | 0.9 | ND | 15.0 | ND | ND |
| 54 | F | 1981 | 3 | 4.8 | ND | 1.8 | 0.5 | ND | ND | 10.5 | ND | ND |
| | Mean | | | 6.3 | | 1.7 | 1.3 | 0.8 | 1.0 | 14.6 | 1.0 | 0.2 |
| | SD | | | 2.2 | | 0.5 | 1.1 | 0.3 | 0.4 | 6.1 | 0.5 | |
| 6 | M | 1981 | 4 | 15.0 | 1.0 | 4.4 | 6.4 | 2.7 | 1.6 | 26.0 | 1.7 | 0.4 |
| 7 | M | 1981 | 4 | 11.0 | NDR | 4.5 | 2.7 | 1.5 | 1.6 | 25.0 | 1.7 | 0.3 |
| 8 | M | 1981 | 4 | 3.9 | ND | 1.1 | 0.8 | 0.7 | 0.6 | 9.1 | 0.6 | NDR |
| 22 | M | 1981 | 4 | 13.0 | 0.3 | 2.7 | 2.1 | 1.7 | 1.8 | 28.0 | 1.7 | 0.4 |
| 28 | M | 1981 | 4 | 5.5 | ND | 1.1 | ND | 0.8 | 0.8 | 14.0 | 0.8 | ND |
| 29 | M | 1981 | 4 | 6.3 | ND | 1.4 | 1.3 | 0.9 | 0.8 | 13.0 | 0.8 | ND |
| 31 | M | 1981 | 4 | 8.3 | ND | 2.2 | 2.4 | 1.2 | ND | 18.0 | ND | ND |
| 41 | M | 1981 | 4 | 11.0 | ND | 2.6 | 1.1 | 1.4 | 1.7 | 27.0 | 1.7 | ND |
| 43 | M | 1981 | 4 | 37.0 | ND | 7.7 | 12.0 | 9.0 | 5.1 | 77.0 | 4.7 | 1.1 |
| 45 | M | 1981 | 4 | 15.0 | ND | 2.6 | ND | ND | ND | 32.0 | ND | ND |

ont'd./23

| Sample no. | Sex | Year | Group | 183 | 185 | 174 | 177 | 171 | 172 | 180 | 193 | 191 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | 20.0 | ND | 4.4 | 2.4 | 2.7 | 3.0 | 46.0 | 3.4 | ND |
| | Mean | | | 13.3 | 0.6 | 3.2 | 3.5 | 2.3 | 1.9 | 28.6 | 1.9 | 0.5 |
| | SD | | | 9.2 | 0.5 | 2.0 | 3.6 | 2.5 | 1.4 | 19.0 | 1.3 | 0.4 |
| 4 | F | 1991 | 7 | 5.5 | 0.1 | 0.6 | 0.9 | 0.8 | 0.8 | 14.0 | 0.8 | 0.2 |
| 6 | F | 1991 | 7 | 4.1 | 0.1 | 0.7 | 0.8 | 0.5 | 0.5 | 9.6 | 0.5 | 0.2 |
| 8 | F | 1991 | 7 | 3.8 | 0.1 | 0.5 | 0.6 | 0.5 | 0.5 | 9.5 | NDR | 0.2 |
| 10 | F | 1991 | 7 | 9.3 | 0.5 | 1.5 | 3.5 | 1.8 | 1.3 | 20.0 | 0.9 | 0.3 |
| 18 | F | 1991 | 7 | 7.3 | ND | 1.7 | NDR | 1.0 | 1.2 | 18.0 | 1.1 | 0.3 |
| 19 | F | 1991 | 7 | 2.3 | ND | 0.5 | ND | ND | ND | 5.8 | ND | ND |
| 25 | F | 1991 | 7 | 8.6 | 0.2 | 1.6 | 1.6 | 1.0 | NDR | 21.0 | 1.1 | 0.3 |
| | Mean | | | 5.8 | 0.2 | 1.0 | 1.5 | 0.9 | 0.9 | 14.0 | 0.9 | 0.2 |
| | SD | | | 2.6 | 0.2 | 0.6 | 1.2 | 0.5 | 0.4 | 5.9 | 0.2 | 0.1 |
| 1 | M | 1991 | 8 | 3.5 | ND | 0.3 | 0.3 | 0.6 | 0.6 | 11.0 | NDR | 0.2 |
| 3 | M | 1991 | 8 | 6.4 | NDR | 0.9 | 0.7 | 0.9 | 1.0 | 18.0 | NDR | 0.2 |
| 11 | M | 1991 | 8 | 3.1 | 0.1 | 0.4 | 1.0 | 0.5 | 0.4 | 7.2 | NDR | 0.1 |
| 13 | M | 1991 | 8 | 14.5 | ND | 2.2 | 1.1 | 2.0 | 2.4 | 40.0 | 2.2 | ND |
| 14 | M | 1991 | 8 | 9.6 | 0.1 | 1.3 | 1.1 | 1.4 | 1.6 | 25.0 | NDR | 0.4 |
| 15 | M | 1991 | 8 | 10.0 | ND | 1.3 | 1.0 | 1.5 | 1.7 | 29.0 | 1.3 | 0.4 |
| 17 | M | 1991 | 8 | 9.6 | 0.4 | 1.5 | 2.0 | 1.4 | NDR | 21.0 | 1.4 | 0.3 |

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Cont'd./24

| Sample no. | Sex | Year | Group | 183 | 185 | 174 | 177 | 171 | 172 | 180 | 193 | 191 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | 9.3 | 0.3 | 2.2 | 2.6 | 1.4 | 1.3 | 21.0 | 1.6 | 0.4 |
| 23 | M | 1991 | 8 | 11.0 | ND | NDR | 2.5 | 1.7 | 1.5 | 25.0 | 1.7 | ND |
| 24 | M | 1991 | 8 | 6.3 | 0.3 | 3.3 | 2.0 | 1.0 | 0.8 | 14.0 | 1.0 | 0.2 |
| 28 | M | 1991 | 8 | 7.3 | ND | 1.4 | 2.0 | 1.2 | 1.0 | 15.5 | 1.0 | 0.2 |
| | Mean | | | 8.2 | 0.2 | 1.5 | 1.5 | 1.2 | 1.2 | 20.6 | 1.5 | 0.3 |
| | SD | | | 3.3 | 0.1 | 0.9 | 0.8 | 0.5 | 0.6 | 9.1 | 0.4 | 0.1 |

ND: Not detected

NDR: Outside acceptable range of ratio sample:standard stable isotopes

Cont'd./25

| Sample no. | Sex | Year | Group | 170/19 | 189 | 201 | 197 | 198 | 199 | 196/20 | 195 | 194 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | 4.4 | ND | 0.1 | ND | NDR | 2.9 | 2.8 | NDR | 1.1 |
| 19 | F | 1981 | 3 | 3.6 | ND | ND | ND | ND | 1.3 | 1.1 | ND | 0.4 |
| 27 | F | 1981 | 3 | 3.0 | ND | ND | ND | ND | 1.0 | 1.0 | ND | ND |
| 30 | F | 1981 | 3 | 7.8 | ND | ND | ND | ND | 3.8 | 3.6 | ND | ND |
| 42 | F | 1981 | 3 | 7.9 | ND | ND | ND | ND | 5.1 | 4.9 | ND | 1.9 |
| 50 | F | 1981 | 3 | 5.1 | ND | ND | ND | ND | 1.4 | 1.7 | ND | ND |
| 54 | F | 1981 | 3 | 3.5 | ND | ND | ND | ND | 2.7 | 2.4 | ND | ND |
| | Mean | | | 5.0 | | 0.1 | | | 2.6 | 2.5 | | 1.1 |
| | SD | | | 2.0 | | | | | 1.5 | 1.4 | | 0.7 |
| 6 | M | 1981 | 4 | 8.7 | ND | 0.4 | NDR | NDR | 3.8 | 4.0 | 0.4 | 1.8 |
| 7 | M | 1981 | 4 | 8.9 | ND | ND | 0.7 | ND | 3.5 | 4.0 | 0.3 | 1.6 |
| 8 | M | 1981 | 4 | 3.2 | ND | ND | NDR | ND | 1.1 | 1.3 | ND | 0.6 |
| 22 | M | 1981 | 4 | 10.0 | ND | ND | ND | ND | 4.2 | 4.0 | 0.5 | 1.3 |
| 28 | M | 1981 | 4 | 4.8 | ND | ND | ND | ND | 1.9 | 1.9 | ND | ND |
| 29 | M | 1981 | 4 | 4.5 | ND | ND | ND | ND | 1.7 | 1.7 | ND | ND |
| 31 | M | 1981 | 4 | 6.6 | ND | ND | ND | ND | 2.5 | 2.1 | ND | ND |
| 41 | M | 1981 | 4 | 10.0 | ND | ND | ND | ND | 3.7 | 3.8 | ND | ND |
| 43 | M | 1981 | 4 | 28.0 | ND | 2.4 | ND | ND | 13.0 | 13.0 | ND | 5.4 |
| 45 | M | 1981 | 4 | 12.0 | ND | ND | ND | ND | 4.9 | 5.3 | ND | 1.9 |



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ont'd./ 26

| Sample no. | Sex | Year | Group | 170/19 | 189 | 201 | 197 | 198 | 199 | 196/20 | 195 | 194 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | 17.0 | ND | ND | ND | ND | 7.3 | 7.2 | ND | 2.9 |
| | Mean | | | 10.3 | | 1.4 | 0.7 | | 4.3 | 4.4 | 0.4 | 2.2 |
| | SD | | | 7.0 | | 1.4 | | | 3.4 | 3.3 | 0.1 | 1.6 |
| 4 | F | 1991 | 7 | 4.9 | NDR | NDR | 0.1 | 0.1 | 1.7 | 1.5 | 0.2 | 1.0 |
| 6 | F | 1991 | 7 | 3.3 | ND | NDR | ND | NDR | 1.3 | 1.3 | 0.2 | 0.7 |
| 8 | F | 1991 | 7 | 3.2 | ND | NDR | 0.0 | 0.1 | 1.3 | 1.4 | 0.2 | 0.7 |
| 10 | F | 1991 | 7 | 6.6 | 0.1 | 1.0 | 0.4 | 0.2 | 4.8 | 5.0 | 0.5 | 1.9 |
| 18 | F | 1991 | 7 | 6.0 | ND | ND | 0.4 | 0.1 | 2.9 | 3.2 | 0.1 | 1.7 |
| 19 | F | 1991 | 7 | 1.8 | ND | ND | ND | ND | 0.5 | 0.5 | ND | ND |
| 25 | F | 1991 | 7 | 6.8 | NDR | 0.1 | ND | 0.1 | 2.7 | 2.7 | 0.4 | 1.7 |
| | Mean | | | 4.7 | 0.1 | 0.5 | 0.2 | 0.1 | 2.2 | 2.2 | 0.3 | 1.3 |
| | SD | | | 1.9 | | 0.6 | 0.2 | 0.1 | 1.4 | 1.5 | 0.2 | 0.6 |
| 1 | M | 1991 | 8 | 3.9 | ND | NDR | ND | NDR | 1.1 | 0.9 | 0.1 | 0.4 |
| 3 | M | 1991 | 8 | 6.3 | ND | NDR | NDR | 0.1 | 2.0 | 2.0 | 0.3 | 1.1 |
| 11 | M | 1991 | 8 | 2.6 | 0.0 | NDR | NDR | 0.1 | 0.8 | 0.9 | 0.1 | 0.4 |
| 13 | M | 1991 | 8 | 14.0 | ND | ND | ND | ND | 5.8 | 5.0 | 0.3 | 2.2 |
| 14 | M | 1991 | 8 | 9.4 | NDR | NDR | 0.1 | 0.1 | 2.9 | 3.0 | 0.4 | 1.8 |
| 15 | M | 1991 | 8 | 11.0 | 0.1 | NDR | ND | 0.1 | 2.9 | 3.2 | 0.5 | 2.2 |
| 17 | M | 1991 | 8 | 8.1 | ND | NDR | ND | NDR | 2.5 | 3.1 | 0.5 | 1.6 |

Cont'd./27

| Sample no. | Sex | Year | Group | 170/19 | 189 | 201 | 197 | 198 | 199 | 196/20 | 195 | 194 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | 7.4 | ND | NDR | ND | 0.2 | 2.5 | 2.8 | 0.4 | 1.6 |
| 23 | M | 1991 | 8 | 9.1 | ND | ND | ND | ND | 3.2 | 3.5 | 0.5 | 1.8 |
| 24 | M | 1991 | 8 | 4.8 | 0.1 | ND | ND | ND | 1.9 | 1.8 | NDR | 1.0 |
| 28 | M | 1991 | 8 | 5.6 | ND | 0.0 | 0.0 | 0.1 | 1.7 | 1.8 | 0.3 | 0.7 |
| | Mean | | | 7.5 | 0.1 | 0.0 | 0.1 | 0.1 | 2.5 | 2.5 | 0.3 | 1.3 |
| | SD | | | 3.3 | 0.0 | | 0.0 | 0.0 | 1.3 | 1.2 | 0.1 | 0.7 |

ND: Not detected
NDR: Outside acceptable range of ratio sample:standard stable isotopes

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Cont'd./28

| Sample no. | Sex | Year | Group | 205 | 208 | 207 | 206 | 209 | Total CBs |
|---|---|---|---|---|---|---|---|---|---|
| 15 | F | 1981 | 3 | NDR | 0.2 | 0.2 | 0.3 | 0.1 | 398.2 |
| 19 | F | 1981 | 3 | ND | ND | ND | ND | ND | 410.5 |
| 27 | F | 1981 | 3 | ND | ND | ND | ND | ND | 440.8 |
| 30 | F | 1981 | 3 | ND | ND | ND | ND | ND | 540.7 |
| 42 | F | 1981 | 3 | ND | ND | ND | ND | ND | 580.1 |
| 50 | F | 1981 | 3 | ND | ND | ND | ND | ND | 513.9 |
| 54 | F | 1981 | 3 | ND | ND | ND | ND | ND | 363.3 |
| | Mean | | | | 0.2 | 0.2 | 0.3 | 0.1 | 463.9 |
| | SD | | | | | | | | 81.4 |
| 6 | M | 1981 | 4 | NDR | 0.3 | 0.2 | 0.4 | 0.2 | 1278.8 |
| 7 | M | 1981 | 4 | ND | 0.2 | ND | 0.3 | NDR | 863.4 |
| 8 | M | 1981 | 4 | ND | ND | ND | 0.1 | NDR | 341.8 |
| 22 | M | 1981 | 4 | ND | ND | ND | ND | ND | 983.9 |
| 28 | M | 1981 | 4 | ND | ND | ND | ND | ND | 438.1 |
| 29 | M | 1981 | 4 | ND | ND | ND | ND | ND | 644.1 |
| 31 | M | 1981 | 4 | ND | ND | ND | ND | ND | 828.0 |
| 41 | M | 1981 | 4 | ND | ND | ND | ND | ND | 985.0 |
| 43 | M | 1981 | 4 | ND | ND | ND | ND | ND | 2445.5 |
| 45 | M | 1981 | 4 | ND | ND | ND | ND | ND | 1105.5 |

Cont'd./29

| Sample no. | Sex | Year | Group | 205 | 208 | 207 | 206 | 209 | Total CBs |
|---|---|---|---|---|---|---|---|---|---|
| 47 | M | 1981 | 4 | ND | ND | ND | ND | ND | 1379.4 |
| | Mean | | | | 0.2 | 0.2 | 0.3 | 0.2 | 1026.7 |
| | SD | | | | 0.1 | | 0.1 | | 569.1 |
| 4 | F | 1991 | 7 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 491.2 |
| 6 | F | 1991 | 7 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 311.9 |
| 8 | F | 1991 | 7 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 279.2 |
| 10 | F | 1991 | 7 | 0.2 | 0.3 | 0.2 | 0.4 | 0.3 | 536.7 |
| 18 | F | 1991 | 7 | 0.2 | 0.2 | 0.1 | 0.4 | 0.3 | 495.9 |
| 19 | F | 1991 | 7 | ND | ND | ND | ND | ND | 279.5 |
| 25 | F | 1991 | 7 | 0.2 | 0.1 | 0.0 | 0.3 | 0.1 | 480.4 |
| | Mean | | | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 410.7 |
| | SD | | | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 114.6 |
| 1 | M | 1991 | 8 | 0.1 | 0.0 | ND | 0.1 | 0.0 | 474.4 |
| 3 | M | 1991 | 8 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 550.4 |
| 11 | M | 1991 | 8 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 329.9 |
| 13 | M | 1991 | 8 | ND | ND | ND | ND | ND | 1113.4 |
| 14 | M | 1991 | 8 | 0.2 | 0.1 | 0.0 | 0.2 | 0.1 | 830.4 |
| 15 | M | 1991 | 8 | 0.2 | 0.1 | 0.0 | 0.2 | 0.1 | 886.7 |
| 17 | M | 1991 | 8 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 651.2 |

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Cont'd./30

| Sample no. | Sex | Year | Group | 205 | 208 | 207 | 206 | 209 | Total CBs |
|---|---|---|---|---|---|---|---|---|---|
| 21 | M | 1991 | 8 | 0.2 | 0.2 | ND | 0.2 | 0.2 | 773.5 |
| 23 | M | 1991 | 8 | 0.2 | 0.2 | 0.1 | 0.2 | 0.1 | 715.8 |
| 24 | M | 1991 | 8 | 0.1 | NDR | 0.0 | 0.1 | 0.1 | 607.6 |
| 28 | M | 1991 | 8 | 0.1 | 0.1 | 0.0 | 0.2 | 0.1 | 761.9 |
| | Mean | | | 0.1 | 0.1 | 0.0 | 0.2 | 0.1 | 699.6 |
| | SD | | | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 212.9 |

ND: Not detected

NDR: Outside acceptable range of ratio sample:standard stable isotopes

**Table 13: Comparison of analyses by Axys and BIO laboratories of DDT-group residues in 17 samples of Holman ringed seal *(Phoca hispida)* blubber taken in 1981.**

**(Axys data from Axys contract files 2894. Data from BIO labs taken from files OCBIO81F.XLS and OCBIO81M.XLS.)**

| Sample no. | Sex | Axys Lipid % wet wt | Axys *p,p'*-DDE ng/g lipid | Axys *p,p'*-DDD ng/g lipid | Axys *p,p'*-DDT ng/g lipid | Axys Total DDT ng/g lipid |
|---|---|---|---|---|---|---|
| 15 | F | 88.0 | 110 | 25 | 160 | 295 |
| 19 | F | 88.5 | 195 | 23 | 145 | 363 |
| 27 | F | 95.0 | 190 | 10 | 160 | 360 |
| 30 | F | 94.0 | 220 | 15 | 210 | 450 |
| 42 | F | 91.0 | 190 | 12 | 200 | 402 |
| 50 | F | 86.0 | 260 | 11 | 160 | 433 |
| 54 | F | 89.5 | 96 | 11 | 145 | 252 |
| 6 | M | 89.0 | 470 | 65 | 410 | 959 |
| 7 | M | 86.0 | 380 | 55 | 330 | 765 |
| 8 | M | 86.0 | 150 | 18 | 120 | 288 |
| 22 | M | 91.0 | 380 | 23 | 290 | 696 |
| 29 | M | 93.0 | 210 | 13 | 160 | 390 |
| 31 | M | 94.0 | 290 | 20 | 230 | 541 |
| 41 | M | 91.0 | 400 | 33 | 320 | 753 |
| 43 | M | 84.0 | 1200 | 62 | 700 | 1963 |
| 45 | M | 90.0 | 480 | 28 | 380 | 888 |
| 47 | M | 87.0 | 630 | 50 | 510 | 1190 |
| Mean | | 89.6 | 344 | 27.9 | 272 | 646 |
| SD | | 3.2 | 265 | 18.6 | 157 | 433 |

Cont'd./2

| Sample no. | BIO Lipid % wet wt. | BIO *p,p'*-DDE ng/g lipid | BIO *p,p'*-DDT ng/g lipid | BIO Total DDT ng/g lipid | Ratio Axys/BIO *p,p'*-DDE | Ratio Axys/BIO *p,p'*-DDT |
|---|---|---|---|---|---|---|
| 15 | 103.3 | 40 | 200 | 240 | 2.76 | 0.80 |
| 19 | 97.4 | 140 | 130 | 270 | 1.39 | 1.12 |
| 27 | 99.8 | 140 | 130 | 270 | 1.36 | 1.23 |
| 30 | 95.7 | 170 | 240 | 410 | 1.29 | 0.88 |
| 42 | 94.2 | 160 | 200 | 360 | 1.19 | 1.00 |
| 50 | 94.9 | 170 | 180 | 350 | 1.53 | 0.89 |
| 54 | 96.2 | 70 | 160 | 230 | 1.37 | 0.91 |
| 6 | 100.6 | 730 | 260 | 990 | 0.64 | 1.58 |
| 7 | 101 | 480 | 330 | 810 | 0.79 | 1.00 |
| 8 | 100.3 | 170 | 130 | 300 | 0.88 | 0.93 |
| 22 | 99.1 | 400 | 290 | 690 | 0.95 | 1.00 |
| 29 | 99.8 | 170 | 210 | 380 | 1.24 | 0.76 |
| 31 | 99.1 | 220 | 210 | 430 | 1.32 | 1.10 |
| 41 | 97.1 | 330 | 340 | 670 | 1.21 | 0.94 |
| 43 | 95.1 | 250 | 1130 | 1380 | 4.80 | 0.62 |
| 45 | 91.2 | 430 | 500 | 930 | 1.12 | 0.76 |
| 47 | 93.2 | 560 | 620 | 1180 | 1.13 | 0.82 |
| Mean | 97.5 | 272 | 309 | 582 | 1.47 | 0.96 |
| SD | 3.2 | 188 | 249 | 359 | 0.97 | 0.22 |

Cont'd./3

| Sample no. | Ratio Axys/BIO Total DDT |
|---|---|
| 15 | 1.23 |
| 19 | 1.34 |
| 27 | 1.33 |
| 30 | 1.10 |
| 42 | 1.12 |
| 50 | 1.24 |
| 54 | 1.10 |
| 6 | 0.97 |
| 7 | 0.94 |
| 8 | 0.96 |
| 22 | 1.01 |
| 29 | 1.03 |
| 31 | 1.26 |
| 41 | 1.12 |
| 43 | 1.42 |
| 45 | 0.95 |
| 47 | 1.01 |
| Mean | 1.13 |
| SD | 0.15 |

Table 14: Statistical analysis by paired *t*-test of DDT-group residue concentrations in 17 Holman ringed seal (*Phoca hispida*) blubber samples analysed by Axys and BIO Laboratories.

(Data from file AXBIDDTS.XLS.)

| | Axys | BIO | *t* | *P* |
|---|---|---|---|---|
| Lipid % wet wt | | | | |
| Mean | 89.6 | 97.6 | -7.24 | <0.001 |
| SD | 3.23 | 3.47 | | |
| Residue (ng/g lipid) | | | | |
| *p,p'*-DDE | | | | |
| Mean | 344 | 273 | 1.22 | 0.24 |
| SD | 265 | 188 | | |
| *p,p'*-DDT | | | | |
| Mean | 272 | 308 | -1.27 | 0.22 |
| SD | 157 | 249 | | |
| Total DDT | | | | |
| Mean | 646 | 580 | 1.87 | 0.08 |
| SD | 433 | 359 | | |

Table 15: Analysis by Axys of pesticides in BIO standard solution as described in text.

| Compound | Nominal conc. (BIO) ng/ml | Conc. analysed by Axys ng/ml | BIO conc. as % Axys conc. |
|---|---|---|---|
| HCB | 20.00 | 18.00 | 111 |
| α-HCH | 20.00 | 16.00 | 125 |
| β-HCH | 41.60 | 36.00 | 116 |
| γ-HCH | 40.00 | 37.00 | 108 |
| Heptachlor | 40.00 | 42.00 | 95 |
| Oxychlordane | 80.00 | 37.00 | 216 |
| *trans*-Chlordane | 20.00 | 17.00 | 118 |
| *cis*-Chlordane | 20.00 | 14.00 | 143 |
| *trans*-nonachlor | 20.00 | 14.00 | 143 |
| *p,p'*-DDE | 50.00 | 45.00 | 111 |
| *p,p'*-DDD | 50.00 | 36.00 | 139 |
| *o,p'*-DDT | 50.00 | 56.00 | 89 |
| *p,p'*-DDT | 50.00 | 45.00 | 111 |
| Mean | | | 125 |
| SD | | | 32 |
| Mean (-oxychlordane) | | | 117 |
| S.D (-oxychlordane) | | | 17 |

Table 16: Comparison of Aroclor 1254 analyses of 17 Holman ringed seal (*Phoca hispida*) blubber samples (1981) by Axys and BIO laboratories. Axys estimates of Aroclor 1254 were calculated from sum of individual congeners; BIO data were calculated using external standards of Aroclor 1254.

(Axys data summarised from Axys contract files 2894; BIO data taken from files OCBIO81F.XLS and OCBIO81M.XLS, Tables 3 and 4.)

| Sample no. | Axys PCBs (Aroclor 1254) (ng/g lipid) | BIO PCBs (Aroclor 1254) (ng/g lipid) |
|---|---|---|
| 15 | 290 | 420 |
| 19 | 345 | 460 |
| 27 | 370 | 500 |
| 30 | 410 | 760 |
| 42 | 370 | 740 |
| 50 | 460 | 710 |
| 54 | 250 | 340 |
| 6 | 1000 | 1680 |
| 7 | 730 | 1270 |
| 8 | 290 | 550 |
| 22 | 800 | 1220 |
| 29 | 530 | 630 |
| 31 | 690 | 810 |
| 41 | 760 | 1170 |
| 43 | 1800 | 2780 |
| 45 | 880 | 1490 |
| 47 | 1100 | 1970 |
| Mean | 651 | 1029 |
| SD | 397 | 654 |

**Table 17: Comparisons between years of age and blubber thickness in female Holman ringed seals (*Phoca hispida*) 1972 - 1991.**

Data from Tables 1-8.

1. Age (y)

| Year: | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 10.9 | 9.6 | 8.1 | 14.3 |
| S.D. | 8.9 | 7.2 | 4.5 | 7.3 |
| n | 13 | 15 | 14 | 7 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 0.43 | 0.66 |
| | 1989 | 1.07 | 0.29 |
| | 1991 | -0.82 | 0.42 |
| 1981 v. | 1989 | 0.68 | 0.50 |
| | 1991 | -1.35 | 0.19 |
| 1989 v. | 1991 | -2.37 | 0.03 |

2. Blubber thickness (cm)

| Year: | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 3.59 | 4.55 | 3.56 | 4.24 |
| S.D. | 0.52 | 0.73 | 1.42 | 0.94 |
| n | 8 | 15 | 14 | 7 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | -3.29 | 0.03 |
| | 1989 | 0.04 | 0.97 |
| | 1991 | -1.70 | 0.11 |
| 1981 v. | 1989 | 2.37 | 0.03 |
| | 1991 | 0.83 | 0.41 |
| 1989 v. | 1991 | -1.14 | 0.27 |

Table 18: Comparisons between years of *p,p'*-DDE and *p,p'*-DDT concentrations in blubber of female Holman ringed seals (*Phoca hispida*) 1972 - 1991.

Data from Tables 1-8.

1. *p,p'*-DDE, ng/g wet wt. blubber

| Year: | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 278 | 135 | 192 | 141 |
| S.D. | 97.6 | 97.8 | 55.9 | 52.5 |
| n | 13 | 15 | 14 | 7 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 3.86 | <0.01 |
| | 1989 | 2.84 | <0.01 |
| | 1991 | 3.43 | <0.01 |
| 1981 v. | 1989 | -1.90 | 0.07 |
| | 1991 | -0.15 | 0.88 |
| 1989 v. | 1991 | 2.00 | 0.06 |

2. *p,p'*-DDT, ng/g wet wt. blubber

| Year: | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 297 | 183 | 81.2 | 61.2 |
| S.D. | 137 | 122 | 28.3 | 19.6 |
| n | 13 | 15 | 14 | 7 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 2.33 | 0.03 |
| | 1989 | 5.77 | <0.01 |
| | 1991 | 4.47 | <0.01 |
| 1981 v. | 1989 | 3.05 | <0.01 |
| | 1991 | 2.60 | 0.02 |
| 1989 v. | 1991 | 1.68 | 0.11 |

Table 19: Comparisons between years of age and blubber thickness in male Holman ringed seals (*Phoca hispida*) 1972 - 1991.

Data from Tables 1-8.

1. Age (y)

| Year: | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 14.5 | 8.9 | 8.6 | 12.3 |
| SD | 9 | 5.4 | 6.8 | 3.6 |
| n | 15 | 16 | 16 | 11 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 2.11 | 0.04 |
| | 1989 | 2.05 | 0.05 |
| | 1991 | 0.76 | 0.45 |
| 1981 v. | 1989 | 0.11 | 0.9 |
| | 1991 | -1.82 | 0.08 |
| 1989 v. | 1991 | -1.63 | 0.11 |

2. Blubber thickness (cm):

| Year: | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 3.2 | 4.48 | 2.9 | 3.45 |
| SD | 0.72 | 0.68 | 1.25 | 0.9 |
| n | 15 | 16 | 16 | 11 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | -5.01 | <0.01 |
| | 1989 | 0.81 | 0.42 |
| | 1991 | -0.77 | 0.45 |
| 1981 v. | 1989 | 4.41 | <0.01 |
| | 1991 | 3.39 | <0.01 |
| 1989 v. | 1991 | -1.24 | 0.22 |

Table 20: Comparisons between years of *p,p'*-DDE and *p,p'*-DDT concentrations in blubber of male Holman ringed seals (*Phoca hispida*) 1972 - 1991.

Data from Tables 1-8.

1. *p,p'*-DDE, ng/g wet wt. blubber

| Year: | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 729 | 393 | 386 | 307 |
| SD | 358 | 320 | 325 | 119 |
| n | 15 | 16 | 16 | 11 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 2.76 | <0.01 |
| | 1989 | 2.79 | <0.01 |
| | 1991 | 3.74 | <0.01 |
| 1981 v. | 1989 | 0.06 | 0.95 |
| | 1991 | 0.85 | 0.4 |
| 1989 v. | 1991 | 0.76 | 0.45 |

2. *p,p'*-DDT, ng/g wet wt. blubber

| Year: | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 526 | 382 | 183 | 110 |
| SD | 235 | 299 | 212 | 43.7 |
| n | 15 | 16 | 16 | 11 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 1.49 | 0.15 |
| | 1989 | 4.27 | <0.01 |
| | 1991 | 5.79 | <0.01 |
| 1981 v. | 1989 | 2.16 | 0.04 |
| | 1991 | 2.97 | <0.01 |
| 1989 v. | 1991 | 1.13 | 0.27 |

Table 21: Comparisons between years of *p,p'*-DDE as % of total DDT in blubber from Holman ringed seal (*Phoca hispida*) 1972 - 1991.

Data,from Tables 1-8.

*p,p'*-DDE as % total DDT in females:

| | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 49.5 | 41.0 | 70.5 | 69.0 |
| SD | 14.4 | 15.6 | 9.30 | 7.93 |
| n | 13 | 15 | 14 | 7 |

*t*-test for independent samples:

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 1.49 | 0.15 |
| | 1989 | -4.50 | <0.01 |
| | 1991 | -3.28 | <0.01 |
| 1981 v. | 1989 | -6.11 | <0.01 |
| | 1991 | -4.44 | <0.01 |
| 1989 v. | 1991 | 0.37 | 0.71 |

*p,p'*-DDE as % total DDT in males:

| | 1972 | 1981 | 1989 | 1991 |
|---|---|---|---|---|
| Mean | 57.0 | 51.5 | 70.8 | 73.4 |
| SD | 9.58 | 11.8 | 9.61 | 5.29 |
| n | 15 | 16 | 16 | 11 |

*t*-test for independent samples:

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | -1.41 | 0.17 |
| | 1989 | -4.00 | <0.01 |
| | 1991 | -5.13 | <0.01 |
| 1981 v. | 1989 | -5.06 | <0.00 |
| | 1991 | -5.74 | <0.00 |
| 1989 v. | 1991 | -0.83 | 0.41 |

Table 22: Comparisons between years of PCB (Aroclor 1254) concentrations in blubber of male and female Holman ringed seal (*Phoca hispida)* 1972 - 1991.

Data from Tables 1-4 and 7-8.

1. Females

| Year: | 1972 | 1981 | 1991 |
|---|---|---|---|
| Aroclor 1254, ng/g wet wt. | | | |
| Mean | 1846 | 557 | 510 |
| SD | 827 | 256 | 180 |
| n | 9 | 15 | 7 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 5.67 | <0.01 |
| 1972 v. | 1991 | 4.17 | <0.01 |
| 1981 v. | 1991 | 0.44 | 0.66 |

2. Males

| Year: | 1972 | 1981 | 1991 |
|---|---|---|---|
| Aroclor 1254, ng/g wet wt. | | | |
| Mean | 3830 | 1279 | 962 |
| SD | 1283 | 751 | 255 |
| n | 15 | 16 | 11 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1972 v. | 1981 | 6.81 | <0.01 |
| 1972 v. | 1991 | 7.27 | <0.01 |
| 1981 v. | 1991 | 1.34 | 0.19 |

Table 23: Comparisons between years of HCB, α–HCH and γ-HCH concentrations in blubber of female Holman ringed seals (*Phoca hispida*) 1981 - 1991.

Data from Table 9

1. HCB, ng/g lipid

| Year: | 1981 | 1989 | 1991 |
|---|---|---|---|
| Mean | 38.9 | 18.9 | 19.3 |
| SD | 9.9 | 9.7 | 6.1 |
| n | 7 | 14 | 7 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1981 v. | 1989 | 4.64 | <0.01 |
| | 1991 | 4.46 | <0.01 |
| 1989 v. | 1991 | 0.95 | 0.35 |

2. α-HCH, ng/g lipid

| Year: | 1981 | 1989 | 1991 |
|---|---|---|---|
| Mean | 146 | 222 | 183 |
| SD | 65 | 226 | 58 |
| n | 7 | 14 | 7 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1981 v. | 1989 | -0.57 | 0.40 |
| | 1991 | -1.12 | 0.28 |
| 1989 v. | 1991 | 0.45 | 0.66 |

3. γ-HCH, ng/g lipid

| Year: | 1981 | 1989 | 1991 |
|---|---|---|---|
| Mean | 6.63 | 23.3 | 7.1 |
| SD | 2.5 | | 5.6 |
| n | 4 | 1 | 7 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1981 v. | 1989 | -6.05 | <0.01 |
| | 1991 | -0.14 | 0.89 |
| 1989 v. | 1991 | -2.73 | 0.03 |

Table 24: Comparisons between years of HCB, α–HCH and γ-HCH concentrations in blubber of male Holman ringed seals (*Phoca hispida*) 1981 - 1991.

Data from Table 10

1. HCB, ng/g lipid

| Year: | 1981 | 1989 | 1991 |
|---|---|---|---|
| Mean | 37.1 | 22.4 | 25.8 |
| SD | 14.4 | 16.1 | 9.8 |
| n | 11 | 16 | 11 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1981 v. | 1989 | 2.43 | 0.02 |
| | 1991 | 2.15 | 0.04 |
| 1989 v. | 1991 | -0.62 | 0.53 |

2. α-HCH, ng/g lipid

| Year: | 1981 | 1989 | 1991 |
|---|---|---|---|
| Mean | 187 | 215 | 199 |
| SD | 55.1 | 155 | 108 |
| n | 11 | 16 | 11 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1981 v. | 1989 | -0.57 | 0.57 |
| | 1991 | -0.32 | 0.75 |
| 1989 v. | 1991 | 0.29 | 0.77 |

3. γ-HCH, ng/g lipid

| Year: | 1981 | 1989 | 1991 |
|---|---|---|---|
| Mean | 13.0 | 18.9 | 7.8 |
| SD | 5.9 | 5.8 | 6.8 |
| n | 8 | 4 | 11 |

Comparisons by *t*-test (unpaired samples)

| | | *t* | *P* |
|---|---|---|---|
| 1981 v. | 1989 | -1.66 | 0.13 |
| | 1991 | 1.73 | 0.10 |
| 1989 v. | 1991 | 2.88 | 0.01 |

Table 25: Comparisons between years of concentrations of other OC pesticides in blubber of female Holman ringed seal (*Phoca hispida*) 1981 - 1991

Data from Table 11

| | 1981 | 1991 | *t* | *P* |
|---|---|---|---|---|
| Oxychlordane, ng/g lipid | | | | |
| Mean | 86.8 | 87.9 | -0.06 | 0.95 |
| SD | 41.3 | 16.2 | | |
| n | 6 | 7 | | |
| | | | | |
| *trans*-Chlordane, ng/g lipid | | | | |
| Mean | 3.19 | 2.58 | 0.61 | 0.56 |
| SD | 1.80 | 1.28 | | |
| n | 5 | 5 | | |
| | | | | |
| *cis*-Chlordane, ng/g lipid | | | | |
| Mean | 27.2 | 37.3 | -0.76 | 0.46 |
| SD | 25.9 | 22.0 | | |
| n | 6 | 7 | | |
| | | | | |
| *trans*-Nonachlor, ng/g lipid | | | | |
| Mean | 109 | 93.0 | 0.48 | 0.64 |
| SD | 36.0 | 75.9 | | |
| n | 6 | 7 | | |
| | | | | |
| *cis*-Nonachlor, ng/g lipid | | | | |
| Mean | 18.0 | 12.1 | 1.13 | 0.28 |
| SD | 11.8 | 6.94 | | |
| n | 6 | 7 | | |
| | | | | |
| Mirex, ng/g lipid | | | | |
| Mean | 5.20 | 5.18 | 0.01 | 1.00 |
| SD | | 2.92 | | |
| n | 1 | 5 | | |
| | | | | |
| Heptachlor epoxide, ng/g lipid | | | | |
| Mean | 23.3 | 29.0 | -1.35 | 0.21 |
| SD | 9.76 | 5.35 | | |
| n | 6 | 7 | | |

Cont'd./2

| | 1981 | 1991 | *t* | *P* |
|---|---|---|---|---|
| Dieldrin, ng/g lipid | | | | |
| Mean | 46.6 | 37.0 | 1.43 | 0.18 |
| SD | 14.8 | 9.00 | | |
| n | 6 | 7 | | |

Table 26: Comparison between years of concentrations of other OC pesticides in blubber of male Holman ringed seal (*Phoca hispida*) 1981 - 1991

Data from Table 11

| | 1981 | 1991 | *t* | *P* |
|---|---|---|---|---|
| Oxychlordane, ng/g lipid | | | | |
| Mean | 188 | 169 | 0.52 | 0.61 |
| SD | 92.5 | 74.5 | | |
| n | 10 | 11 | | |
| | | | | |
| *trans*-Chlordane, ng/g lipid | | | | |
| Mean | 7.24 | 3.62 | 1.61 | 0.13 |
| SD | 5.14 | 2.13 | | |
| n | 8 | 6 | | |
| | | | | |
| *cis*-Chlordane, ng/g lipid | | | | |
| Mean | 69.0 | 61.0 | 0.37 | 0.72 |
| SD | 67.1 | 24.9 | | |
| n | 10 | 11 | | |
| | | | | |
| *trans*-Nonachlor, ng/g lipid | | | | |
| Mean | 314 | 100 | 2.28 | 0.03 |
| SD | 293 | 40.9 | | |
| n | 10 | 10 | | |
| | | | | |
| *cis*-Nonachlor, ng/g lipid | | | | |
| Mean | 46.5 | 18.1 | 2.47 | 0.02 |
| SD | 37.3 | 8.29 | | |
| n | 10 | 11 | | |
| | | | | |
| Mirex, ng/g lipid | | | | |
| Mean | 12.4 | 5.2 | 1.56 | 0.15 |
| SD | 13.4 | 1.55 | | |
| n | 4 | 8 | | |
| | | | | |
| Heptachlor epoxide, ng/g lipid | | | | |
| Mean | 47.1 | 43.7 | 0.45 | 0.66 |
| SD | 21.2 | 13 | | |
| n | 10 | 11 | | |

Cont'd./2

| | 1981 | 1991 | *t* | *P* |
|---|---|---|---|---|
| Dieldrin, ng/g lipid | | | | |
| Mean | 87.6 | 64 | 1.55 | 0.14 |
| SD | 39.9 | 29.5 | | |
| n | 10 | 11 | | |

Table 27: Comparisons between sexes of *p,p'*-DDE and *p,p'*-DDT concentrations in blubber of Holman ringed seals (*Phoca hispida*) 1972 - 1991

Data from Tables 1 - 8

*p,p'*-DDE 1972
(ng/g wet wt.)

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Mean | 278 | 729 | -4.4 | <0.01 |
| SD | 97.6 | 358 | | |
| n | 13 | 15 | | |

*p,p'*-DDE 1981
(ng/g wet wt.)

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Mean | 135 | 393 | -2.99 | <0.01 |
| SD | 97.8 | 320 | | |
| n | 15 | 16 | | |

*p,p'*-DDE 1989
(ng/g wet wt.)

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Mean | 192 | 386 | -2.2 | 0.04 |
| SD | 55.9 | 325 | | |
| n | 14 | 16 | | |

*p,p'*-DDE 1991
(ng/g wet wt.)

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Mean | 141 | 307 | -3.46 | <0.01 |
| SD | 52.5 | 119 | | |
| n | 7 | 11 | | |

Cont'd./2

| *p,p'*-DDT 1972 (ng/g wet wt.) | | | | |
|---|---|---|---|---|
| | Female | Male | *t* | *P* |
| Mean | 297 | 526 | -3.08 | <0.01 |
| SD | 137 | 235 | | |
| n | 13 | 15 | | |

| *p,p'*-DDT 1981 (ng/g wet wt.) | | | | |
|---|---|---|---|---|
| | Female | Male | *t* | *P* |
| Mean | 183 | 382 | -2.39 | 0.02 |
| SD | 122 | 299 | | |
| n | 15 | 16 | | |

| *p,p'*-DDT 1989 (ng/g wet wt.) | | | | |
|---|---|---|---|---|
| | Female | Male | *t* | *P* |
| Mean | 81.2 | 183 | -1.78 | 0.085 |
| SD | 28.3 | 212 | | |
| n | 14 | 16 | | |

| *p,p'*-DDT 1991 (ng/g wet wt.) | | | | |
|---|---|---|---|---|
| | Female | Male | *t* | *P* |
| Mean | 61.2 | 110 | -2.74 | 0.014 |
| SD | 19.6 | 43.7 | | |
| n | 7 | 11 | | |

Table 28: Comparison between sexes of PCB (Aroclor 1254) concentrations (ng/g wet wt.) in blubber of Holman ringed seals (*Phoca hispida*) 1873 - 1991

Data from Tables 1 - 8

1. 1972

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Mean | 1847 | 3830 | -4.13 | <0.01 |
| SD | 827 | 1283 | | |
| n | 9 | 15 | | |

2. 1981

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Mean | 557 | 1279 | -3.53 | <0.01 |
| SD | 256 | 751 | | |
| n | 15 | 16 | | |

3. 1991

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Mean | 510 | 962 | -4.07 | <0.01 |
| SD | 180 | 255 | | |
| n | 7 | 11 | | |

Table 29: Comparison between sexes of HCB, α-HCH and γ-HCH concentrations in blubber from male and female Holman ringed seal (*Phoca hispida*) 1981, 1989 and 1991

(Data from Tables 9 and 10)

1. HCB (ng/g lipid)

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| 1981 | | | | |
| Mean | 38.9 | 37.1 | 0.28 | 0.78 |
| SD | 9.89 | 14.3 | | |
| n | 7 | 11 | | |
| 1989 | | | | |
| Mean | 18.9 | 22.4 | -0.71 | 0.48 |
| SD | 9.74 | 16.1 | | |
| n | 14 | 16 | | |
| 1991 | | | | |
| Mean | 19.3 | 25.8 | -1.57 | 0.13 |
| SD | 6.07 | 9.76 | | |
| n | 7 | 11 | | |

2. α-HCH (ng/g lipid)

| | | | | |
|---|---|---|---|---|
| 1981 | | | | |
| Mean | 146 | 187 | -1.44 | 0.17 |
| SD | 65 | 55.1 | | |
| n | 7 | 16 | | |
| 1989 | | | | |
| Mean | 222 | 215 | 0.11 | 0.92 |
| SD | 226 | 155 | | |
| n | 14 | 16 | | |
| 1991 | | | | |
| Mean | 183 | 199 | -0.36 | 0.72 |
| SD | 58.2 | 108 | | |
| n | 7 | 11 | | |

Cont'd./2

3. γ-HCH (ng/g lipid)

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| 1981 | | | | |
| Mean | 6.62 | 13 | -2.03 | 0.07 |
| SD | 2.47 | 5.87 | | |
| n | 4 | 8 | | |
| 1989 | | | | |
| Mean | 23.3 | 18.9 | 0.68 | 0.55 |
| SD | | 5.83 | | |
| n | 1 | 4 | | |
| 1991 | | | | |
| Mean | 7.06 | 7.78 | -0.23 | 0.82 |
| SD | 5.57 | 6.84 | | |
| n | 7 | 11 | | |

Table 30: Comparison between sexes of concentrations of other OC pesticides in blubber of male and female Holman ringed seal (*Phoca hispida*) 1981

(Data from Table 11)

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Oxychlordane, ng/g lipid | | | | |
| Mean | 86.8 | 188 | -2.5 | 0.03 |
| SD | 41.3 | 92.5 | | |
| n | 6 | 10 | | |
| *trans*-Chlordane, ng/g lipid | | | | |
| Mean | 3.19 | 7.24 | -1.67 | 0.12 |
| SD | 1.8 | 5.14 | | |
| n | 5 | 8 | | |
| *cis*-Chlordane, ng/g lipid | | | | |
| Mean | 27.2 | 69.0 | -1.45 | 0.17 |
| SD | 25.9 | 67.1 | | |
| n | 6 | 10 | | |
| *trans*-Nonachlor, ng/g lipid | | | | |
| Mean | 109 | 310 | -1.68 | 0.12 |
| SD | 36 | 240 | | |
| n | 6 | 10 | | |
| *cis*-Nonachlor, ng/g lipid | | | | |
| Mean | 18 | 46.5 | -1.79 | 0.09 |
| SD | 11.8 | 37.3 | | |
| n | 6 | 10 | | |
| Mirex, ng/g lipid | | | | |
| Mean | 5.2 | 12.4 | -0.48 | 0.67 |
| SD | | 13.4 | | |
| n | 1 | 4 | | |
| Heptachlor epoxide, ng/g lipid | | | | |
| Mean | 23.3 | 47.1 | -2.57 | 0.02 |
| SD | 9.76 | 21.2 | | |
| n | 6 | 10 | | |

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| | | | | |
|---|---|---|---|---|
| Dieldrin, ng/g lipid | | | | |
| Mean | 46.6 | 87.6 | -2.39 | 0.03 |
| SD | 14.8 | 39.9 | | |
| n | 6 | 10 | | |

Table 31: Comparison between sexes of concentrations of other OC pesticides in blubber of male and female Holman ringed seal (*Phoca hispida*) 1991

Data from Table 11

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Oxychlordane, ng/g lipid | | | | |
| Mean | 87.9 | 169 | -2.81 | 0.01 |
| SD | 16.2 | 74.5 | | |
| n | 7 | 11 | | |
| *trans*-Chlordane, ng/g lipid | | | | |
| Mean | 2.58 | 3.62 | -0.94 | 0.37 |
| SD | 1.28 | 2.13 | | |
| n | 5 | 6 | | |
| *cis*-Chlordane, ng/g lipid | | | | |
| Mean | 37.3 | 61.0 | -2.05 | 0.06 |
| SD | 22.0 | 24.9 | | |
| n | 7 | 11 | | |
| *trans*-Nonachlor, ng/g lipid | | | | |
| Mean | 93.0 | 100 | -0.25 | 0.81 |
| SD | 75.9 | 40.9 | | |
| n | 7 | 10 | | |
| *cis*-Nonachlor, ng/g lipid | | | | |
| Mean | 12.1 | 18.1 | -1.60 | 0.13 |
| SD | 6.94 | 8.29 | | |
| n | 7 | 11 | | |
| Mirex, ng/g lipid | | | | |
| Mean | 5.18 | 5.20 | -0.02 | 0.99 |
| SD | 2.92 | 1.56 | | |
| n | 5 | 8 | | |
| Heptachlor epoxide, ng/g lipid | | | | |
| Mean | 29.0 | 43.7 | -2.82 | 0.01 |
| SD | 5.35 | 13.0 | | |
| n | 7 | 11 | | |

Cont'd./2

| | Female | Male | *t* | *P* |
|---|---|---|---|---|
| Dieldrin, ng/g lipid | | | | |
| Mean | 37.0 | 64.0 | -2.33 | 0.03 |
| SD | 8.98 | 29.5 | | |
| n | 7 | 11 | | |

FIG. 1: Regression of Axys analyses on BIO analyses of Aroclor 1254

y=39.666+0.594*x; r=0.98

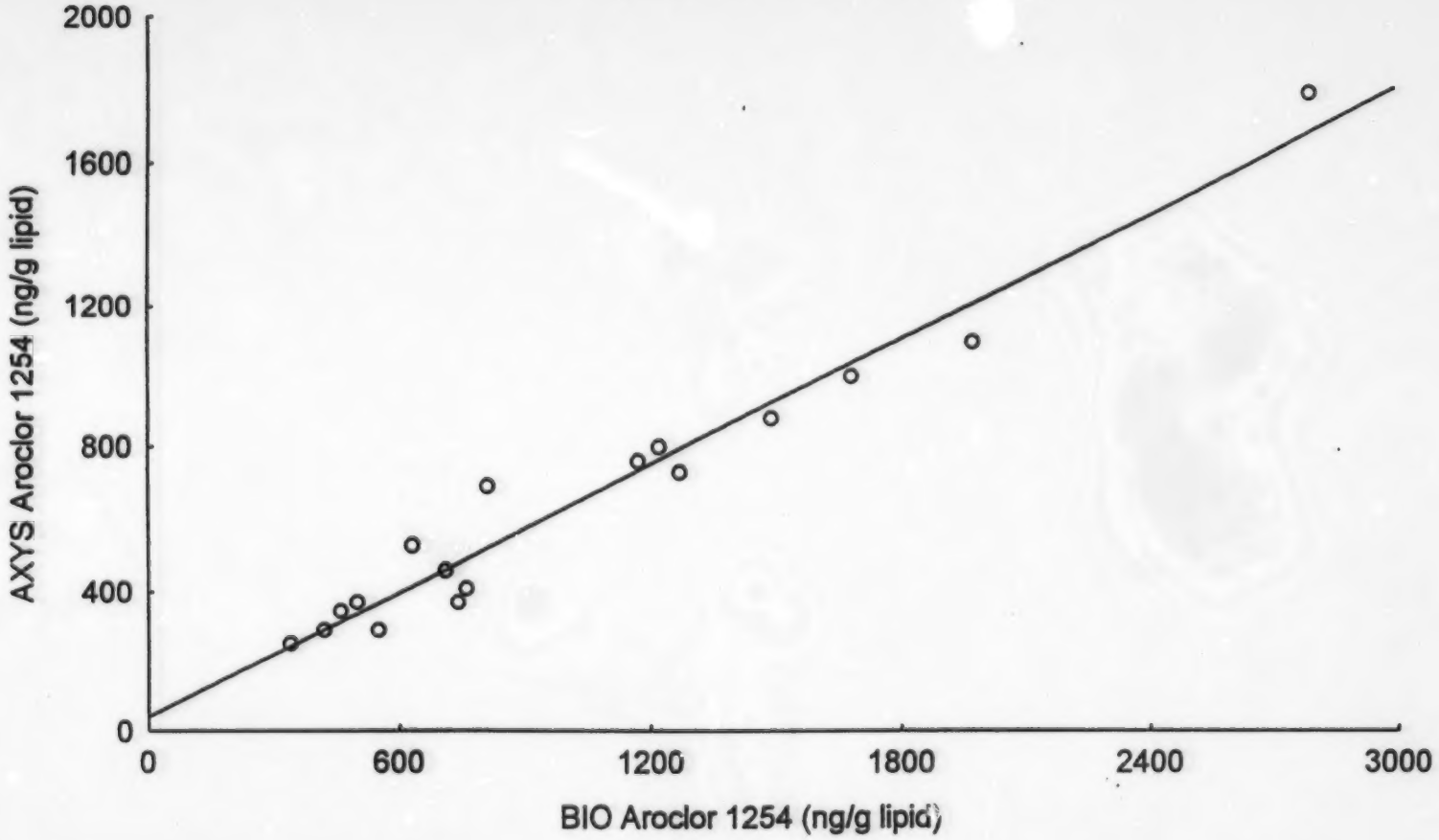


FIG. 2: p,p'-DDE in female Holman ringed seals, 1972-1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

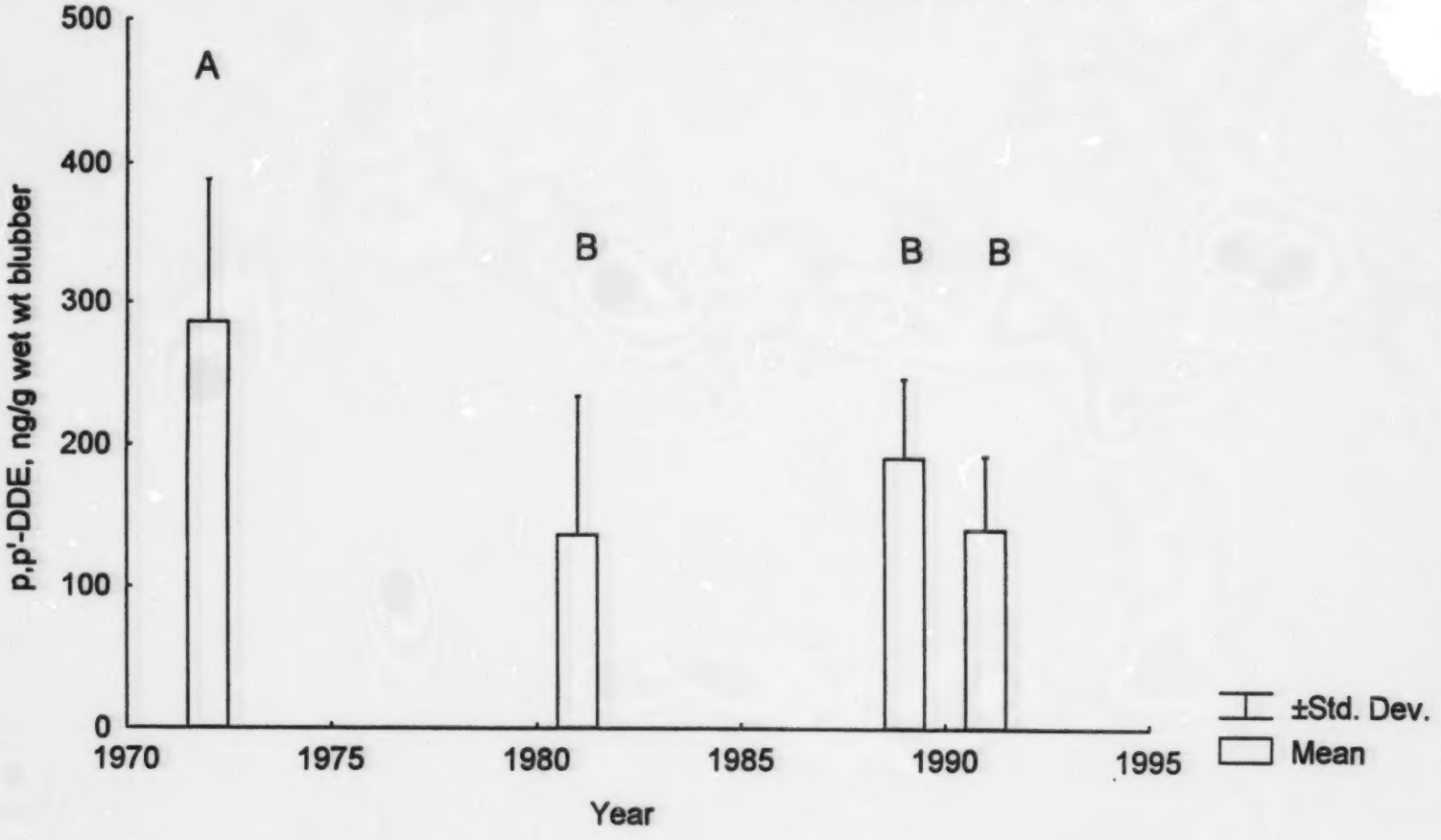


FIG. 3: p,p'-DDT in female Holman ringed seals 1972-91

(Means with the same letter do not differ significantly by t-test: P > 0.05)

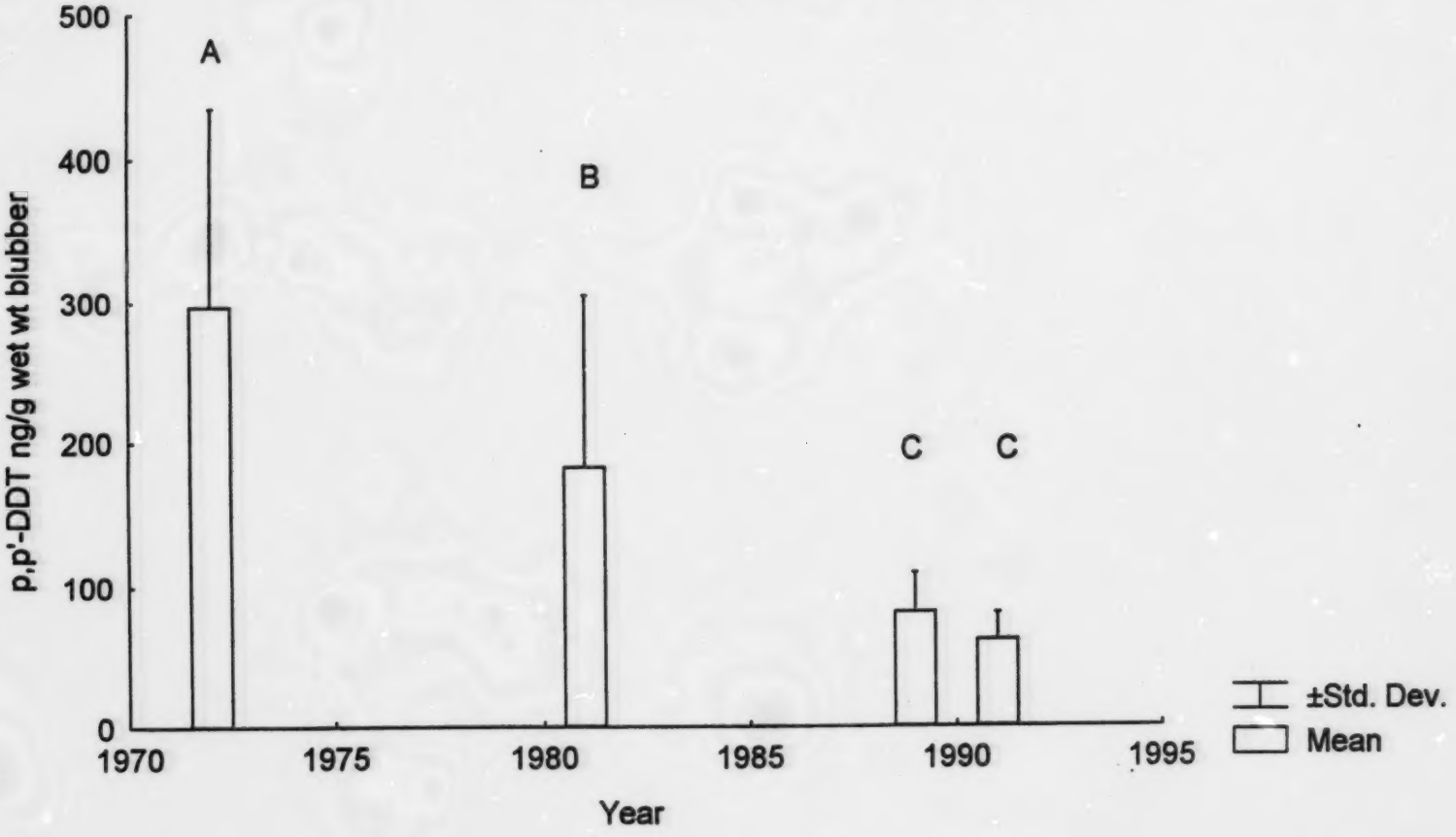


FIG.4 p,p'-DDE in male Holman ringed seals, 1972-91

(Means with the same letter do not differ significantly by t-test: P > 0.05)

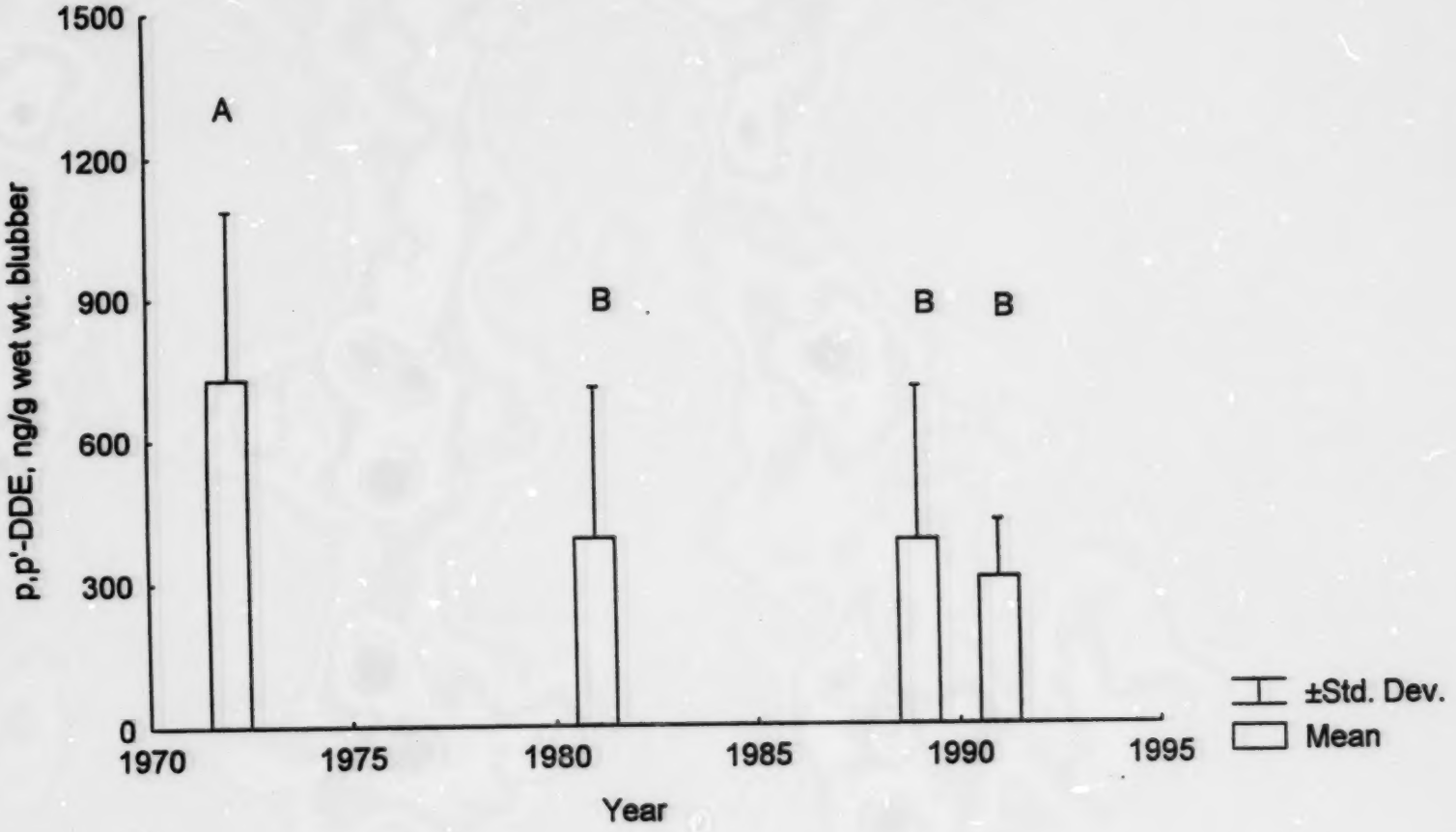


FIG. 5: p,p'-DDT in male Holman ringed seals, 1972-1991

(Means with the same letter do not differ significantly by t-test: P > 0.05)

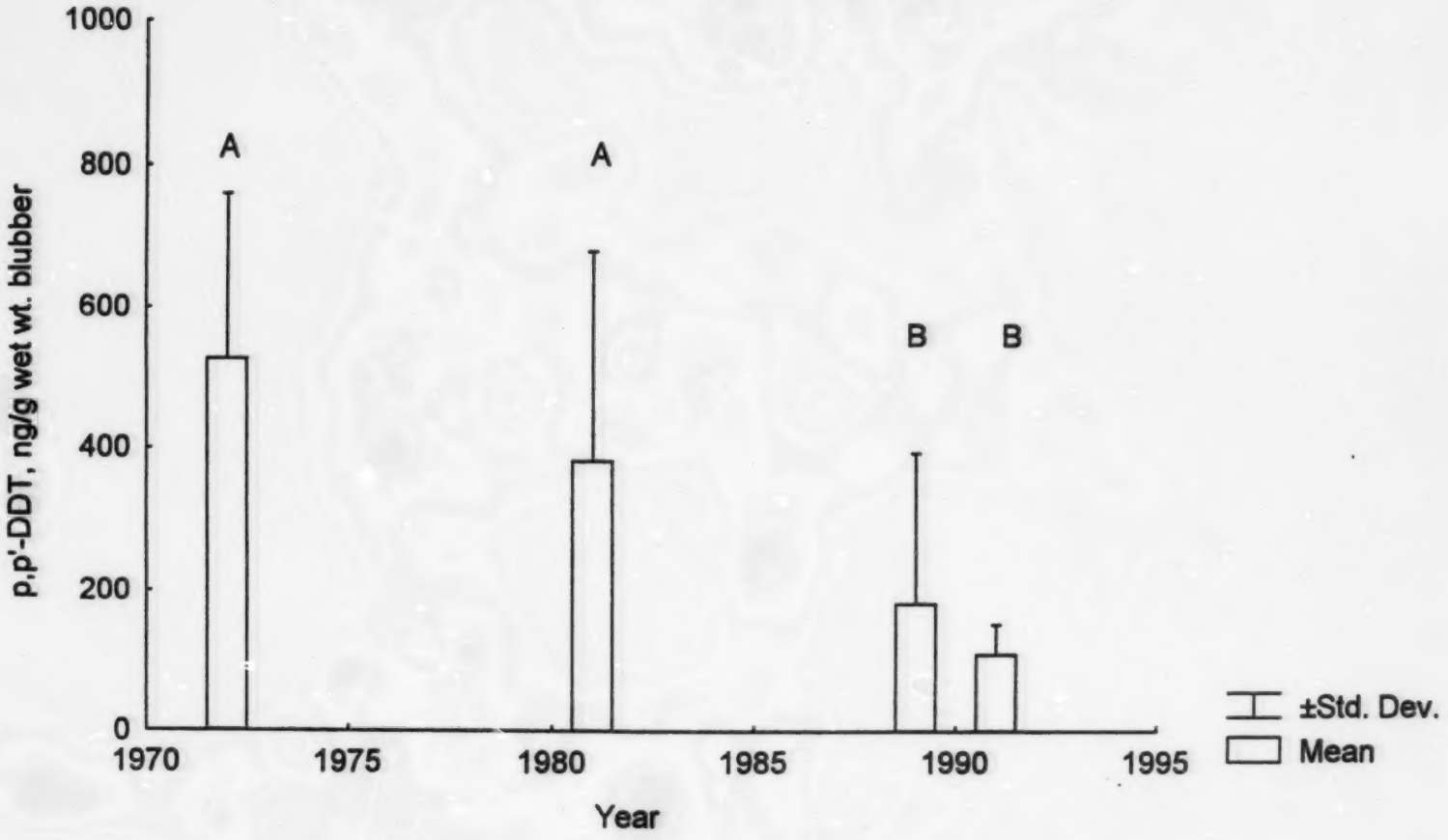


FIG. 6: p,p'-DDE as % total DDT group in female Holman ringed seals, 1972-1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

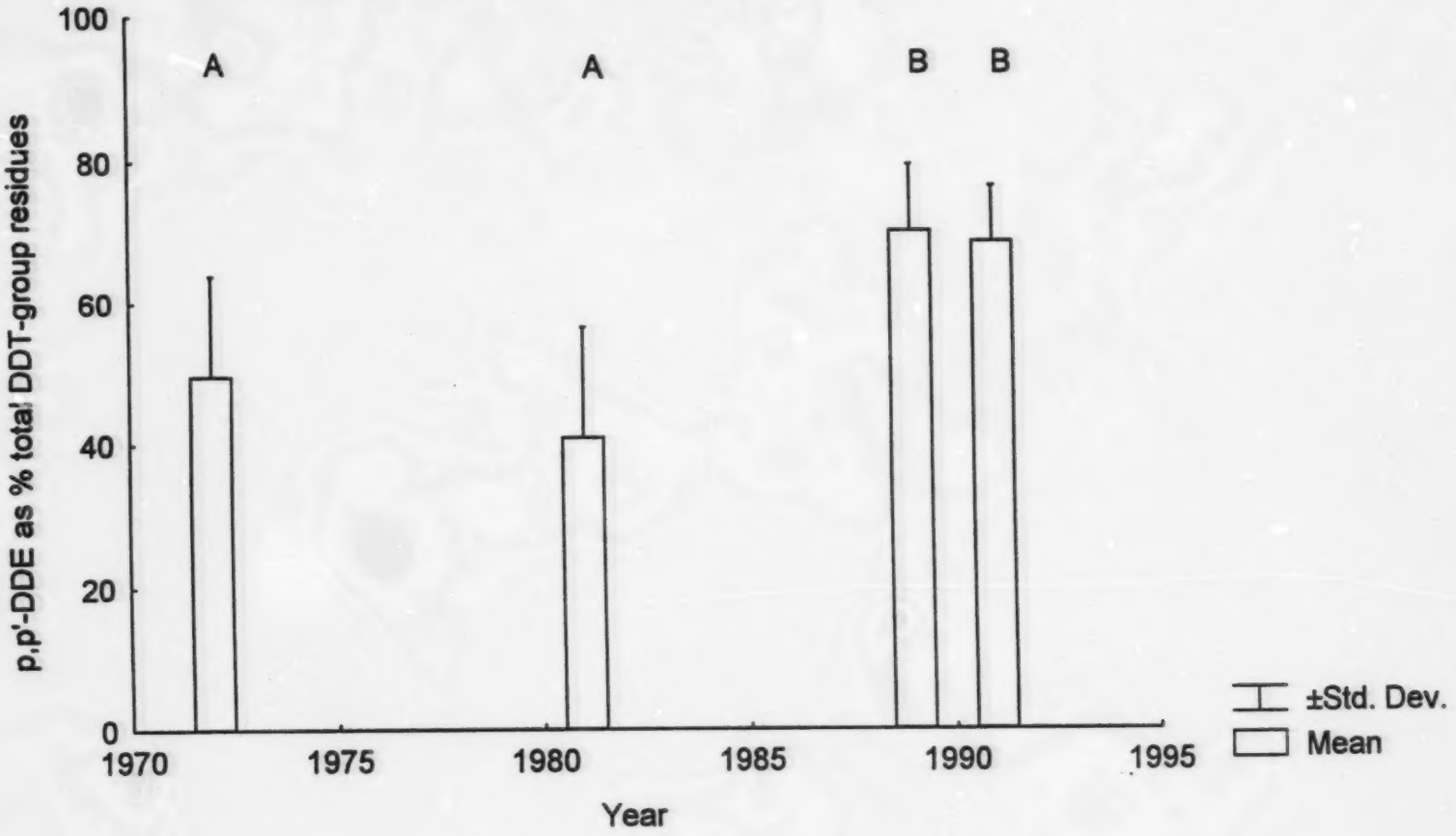


FIG. 7: p,p'-DDE as % total DDT group in male Holman ringed seals, 1972-1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

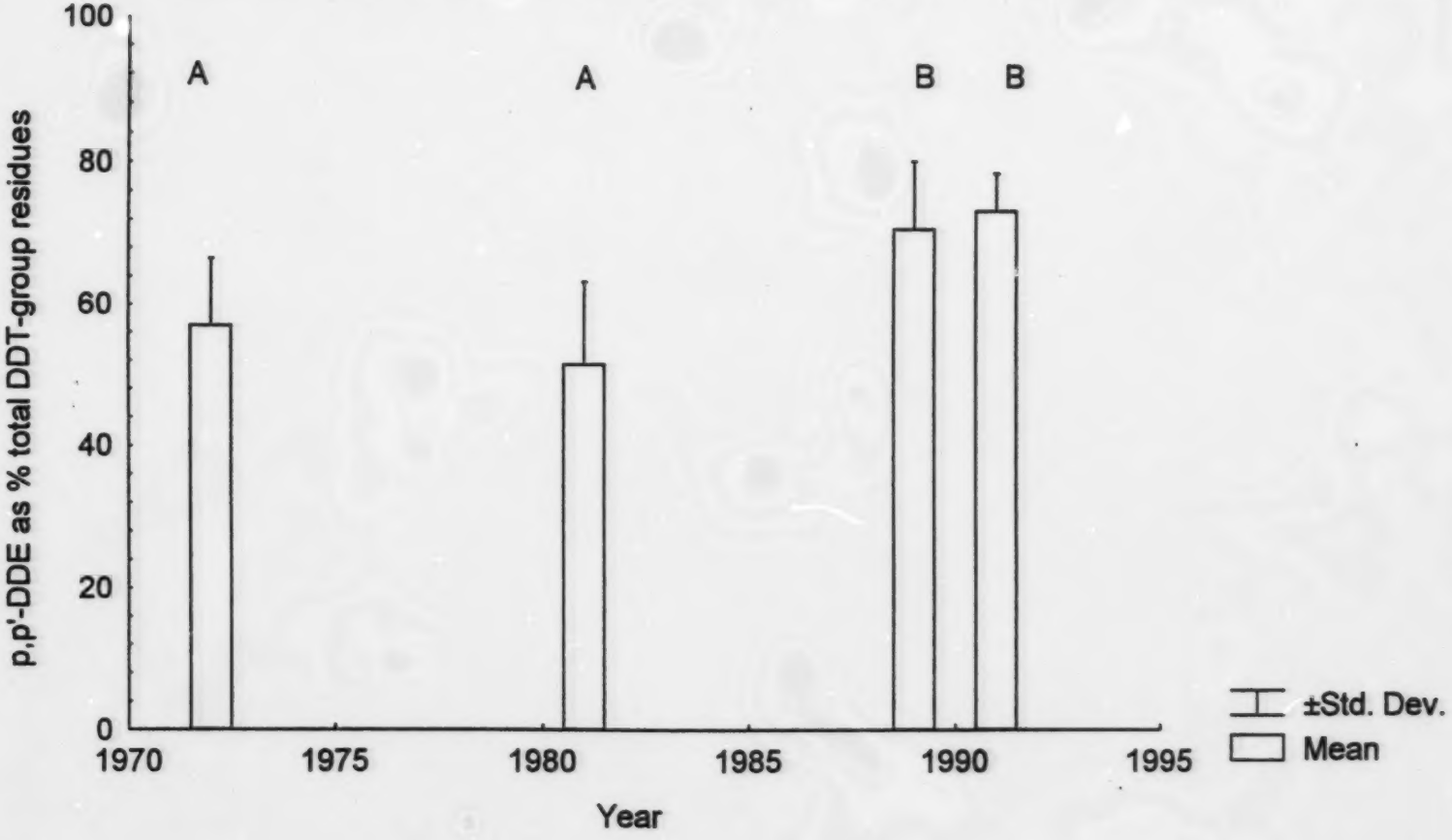


Fig. 8: PCB (Aroclor 1254) in female Holman ringed seals 1972 - 1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

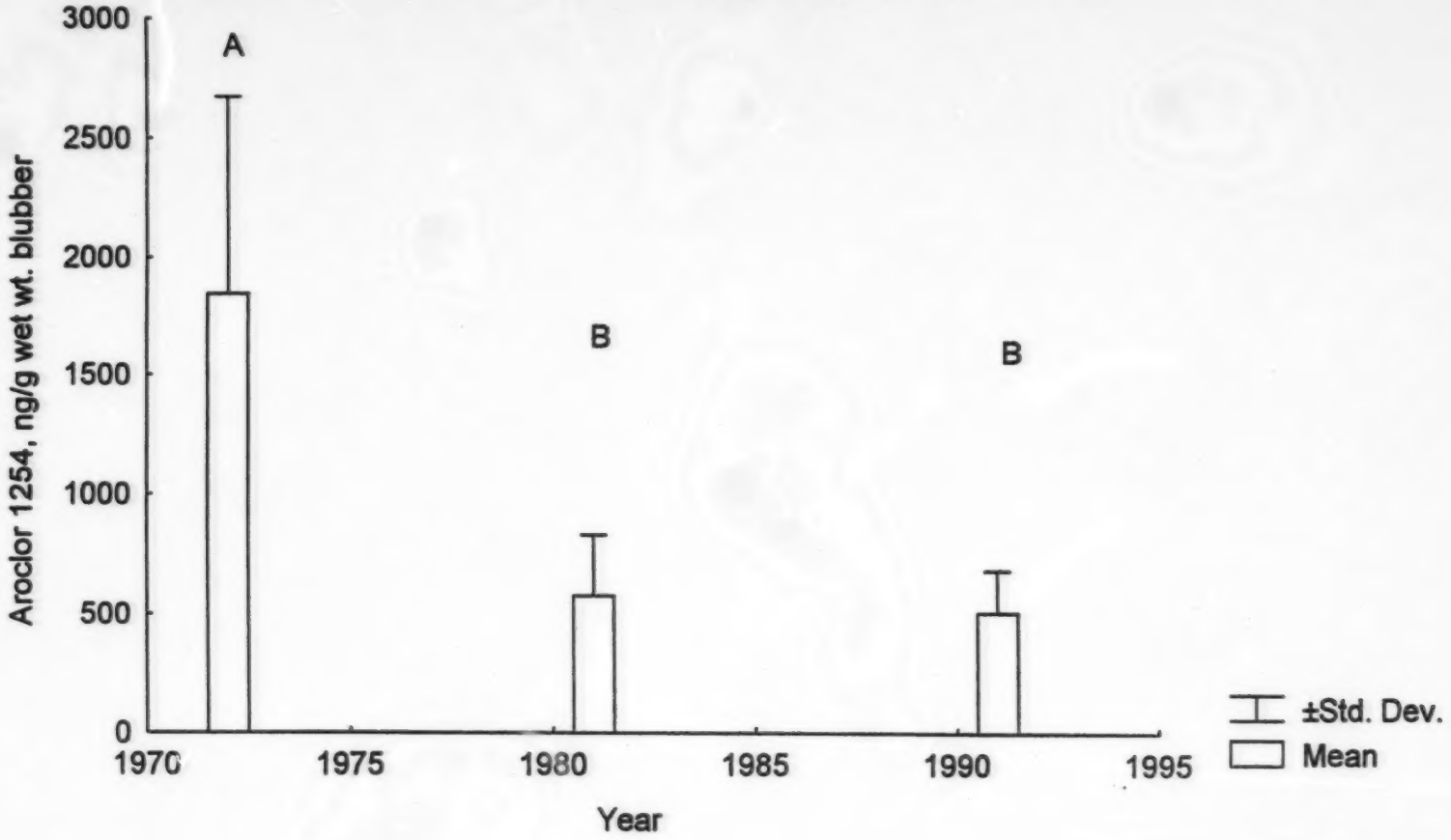


Fig 9: PCB (Aroclor 1254) in male Holman ringed seals 1972 - 1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

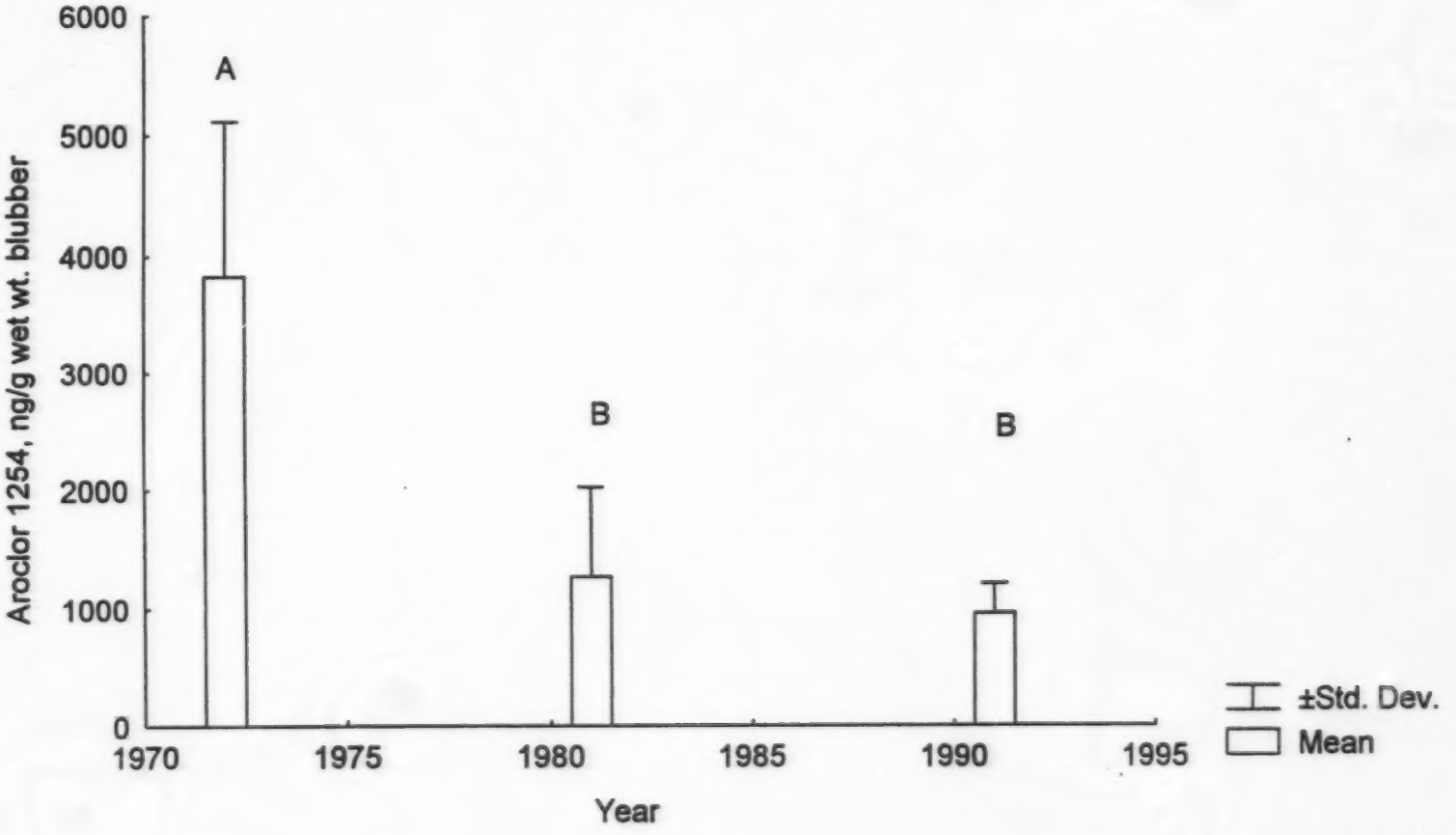


FIG. 10: PCA Scores plot of major chlorobiphenyl congeners (% total CBs; Varimax rotated) in 1981 and 1991 Holman ringed seal Phoca hispida. Codes: 81F, 81M, 91F, 91M: 1981 and 1991 female and male, respectively

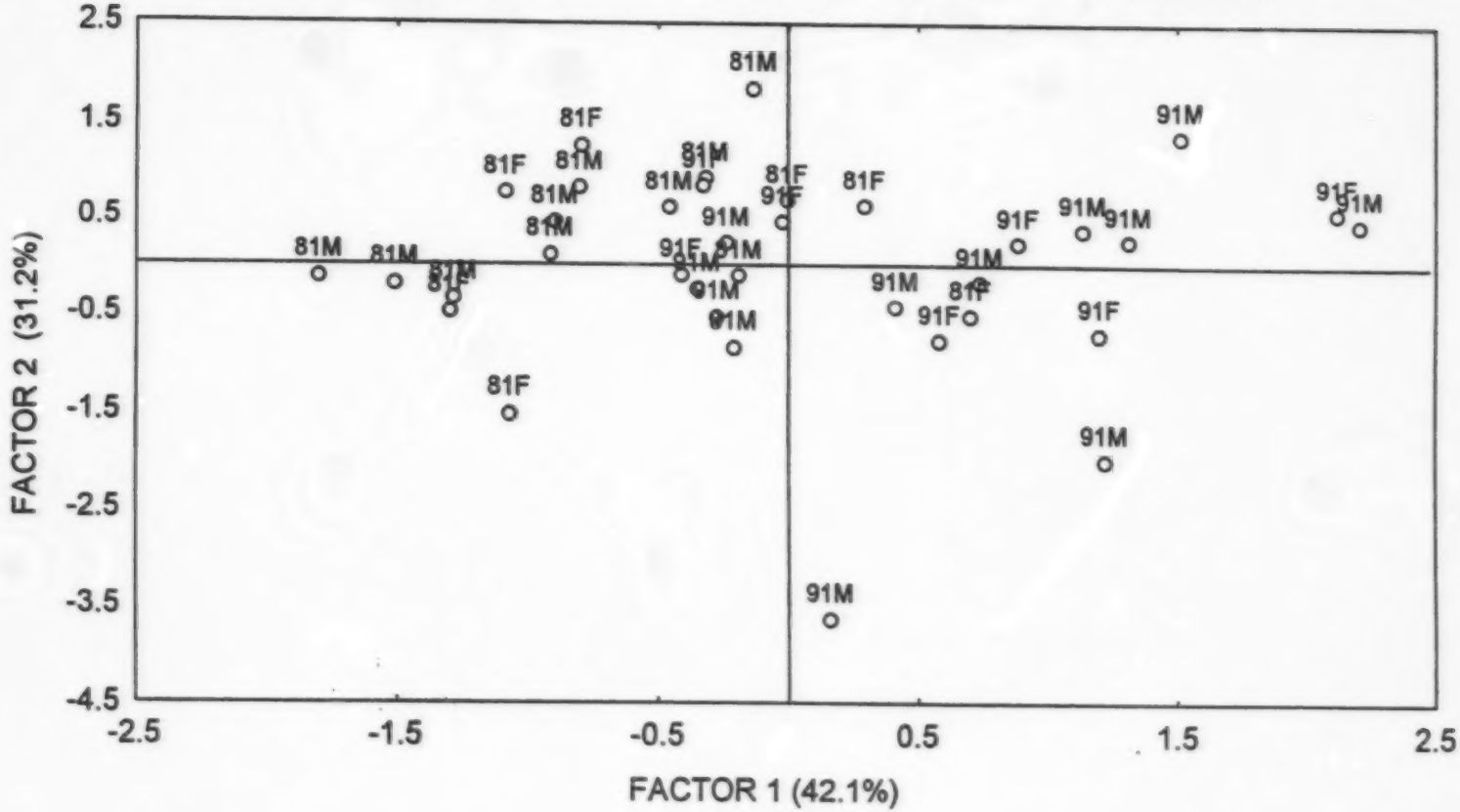


FIG. 11: Major CB Congeners in 1981 and 1991 Holman female ringed seal
(* indicates significant difference, P <0.05)

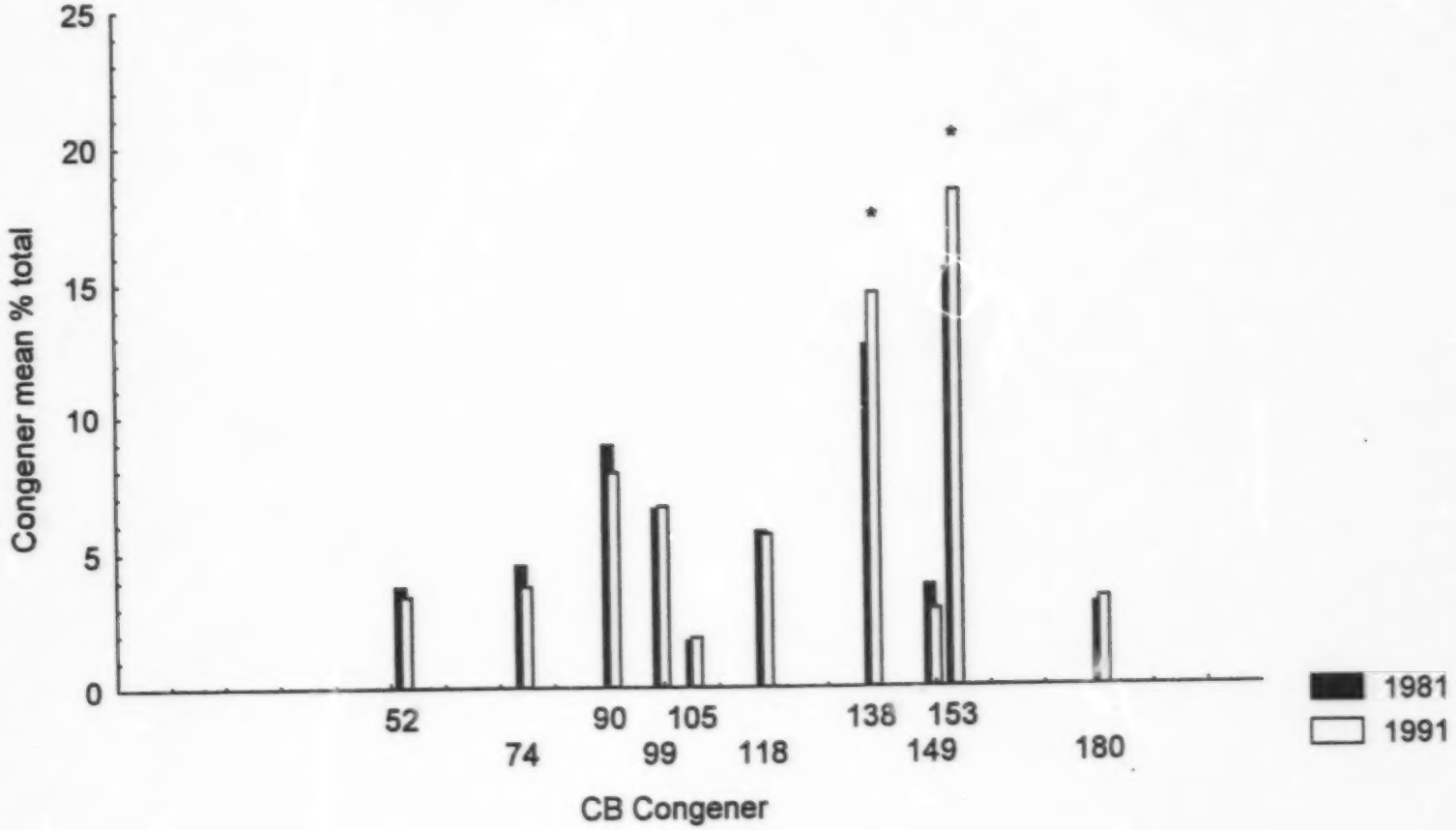


FIG. 12: Major CB congeners in 1981 and 1991 male Holman ringed seals
(* indicates significant difference, P <0.05)

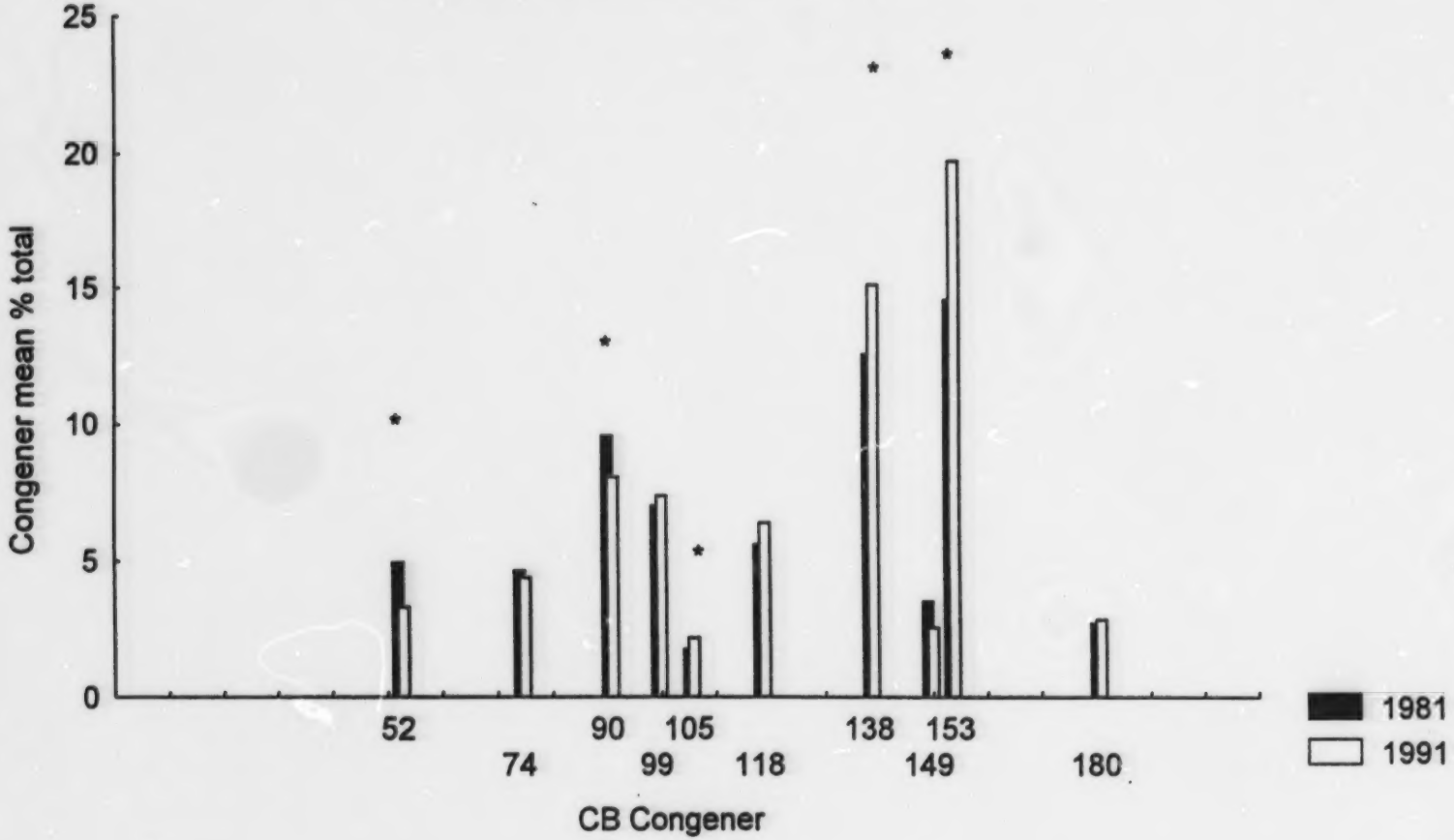


FIG 13: HCB in female Holman ringed seals, 1981-1991

(Means with the same letter do not differ significantly by t-test: P > 0.05)

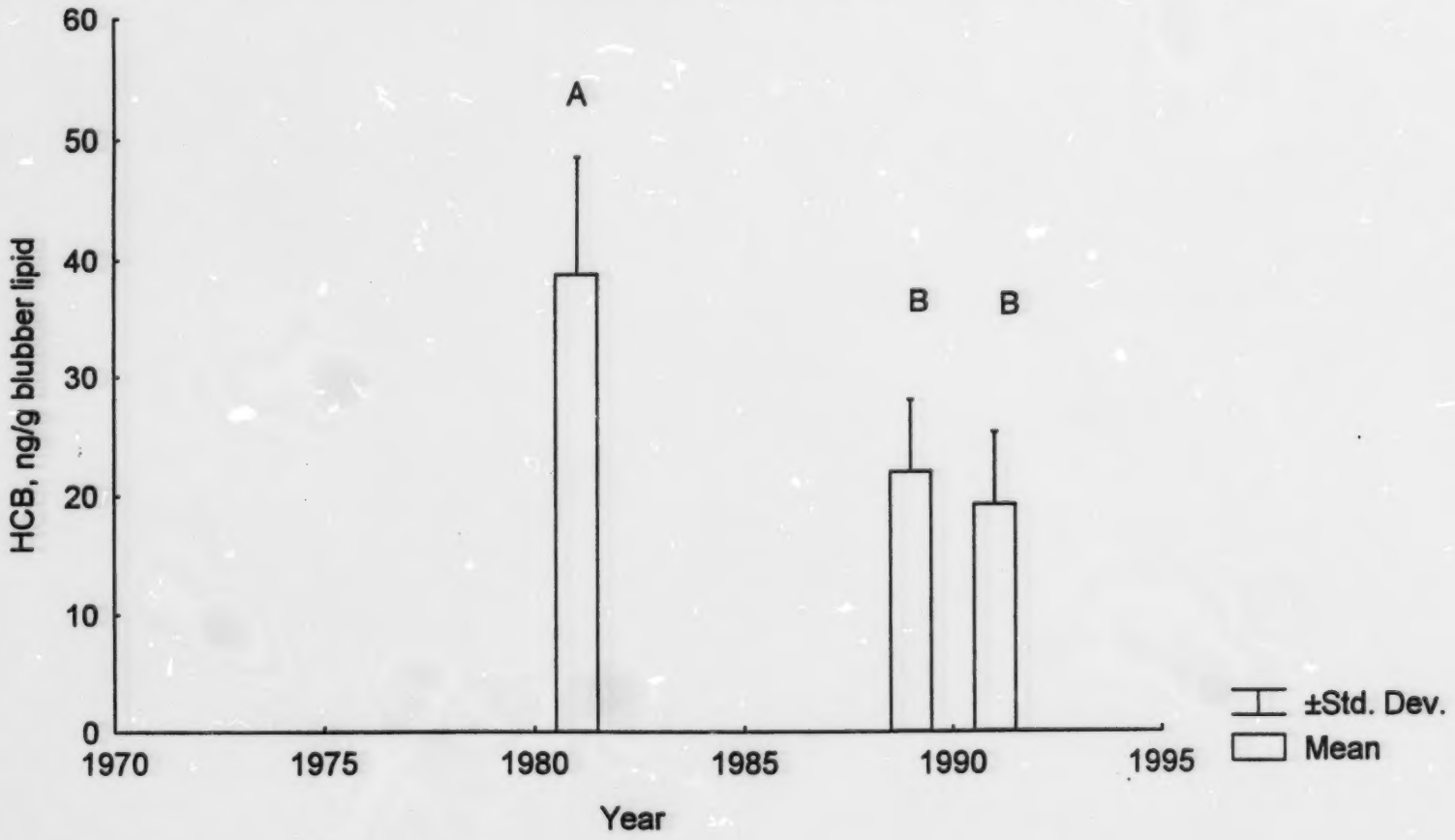


FIG. 14: Alpha-HCH in female Holman ringed seals, 1981-1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

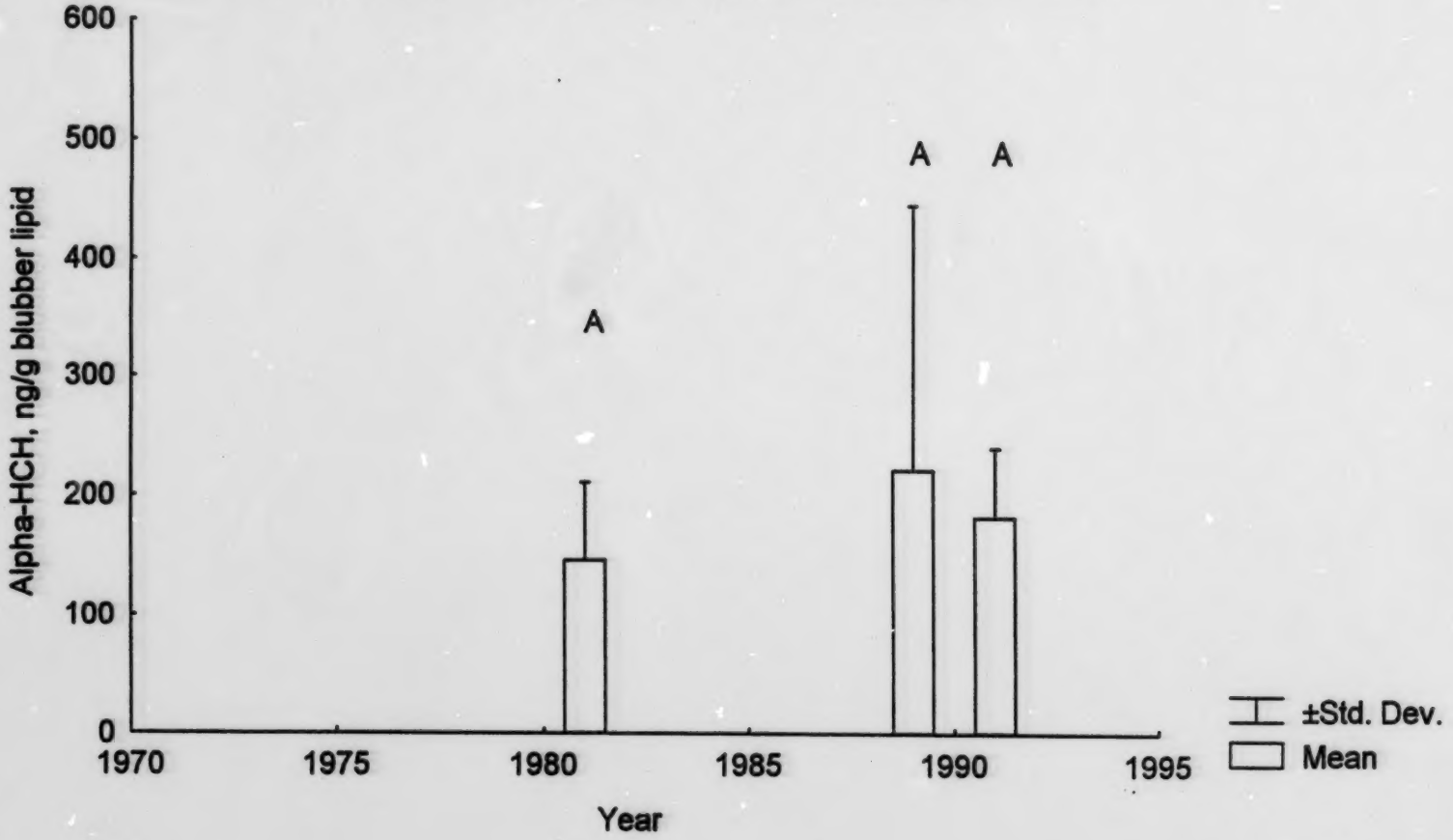


FIG. 15: Gamma-HCH in female Holman ringed seals 1981-1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

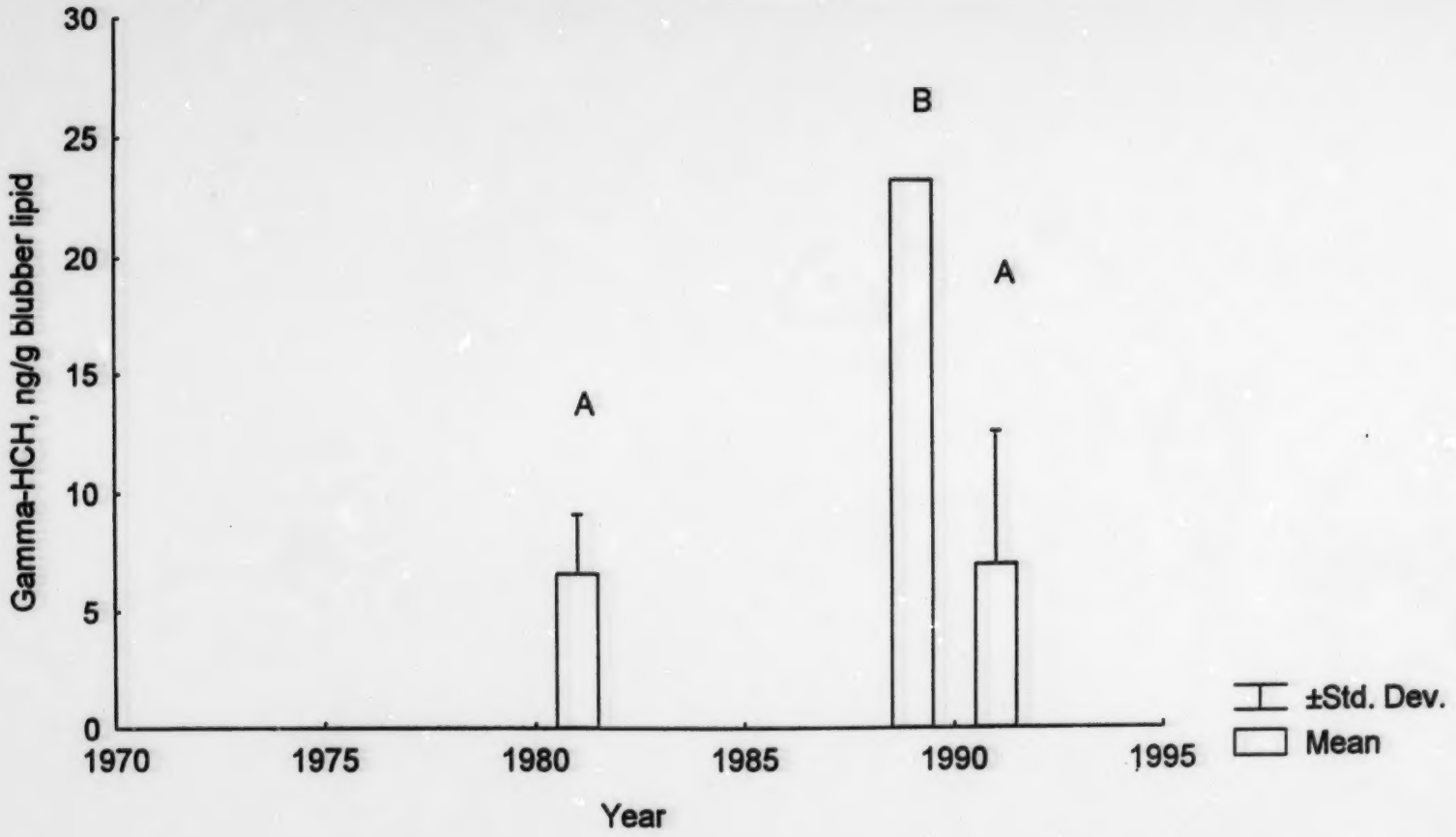


FIG 16: HCB in male Holman ringed seals, 1981-1991

(Means with the same letter do not differ significantly by t-test: P > 0.05)

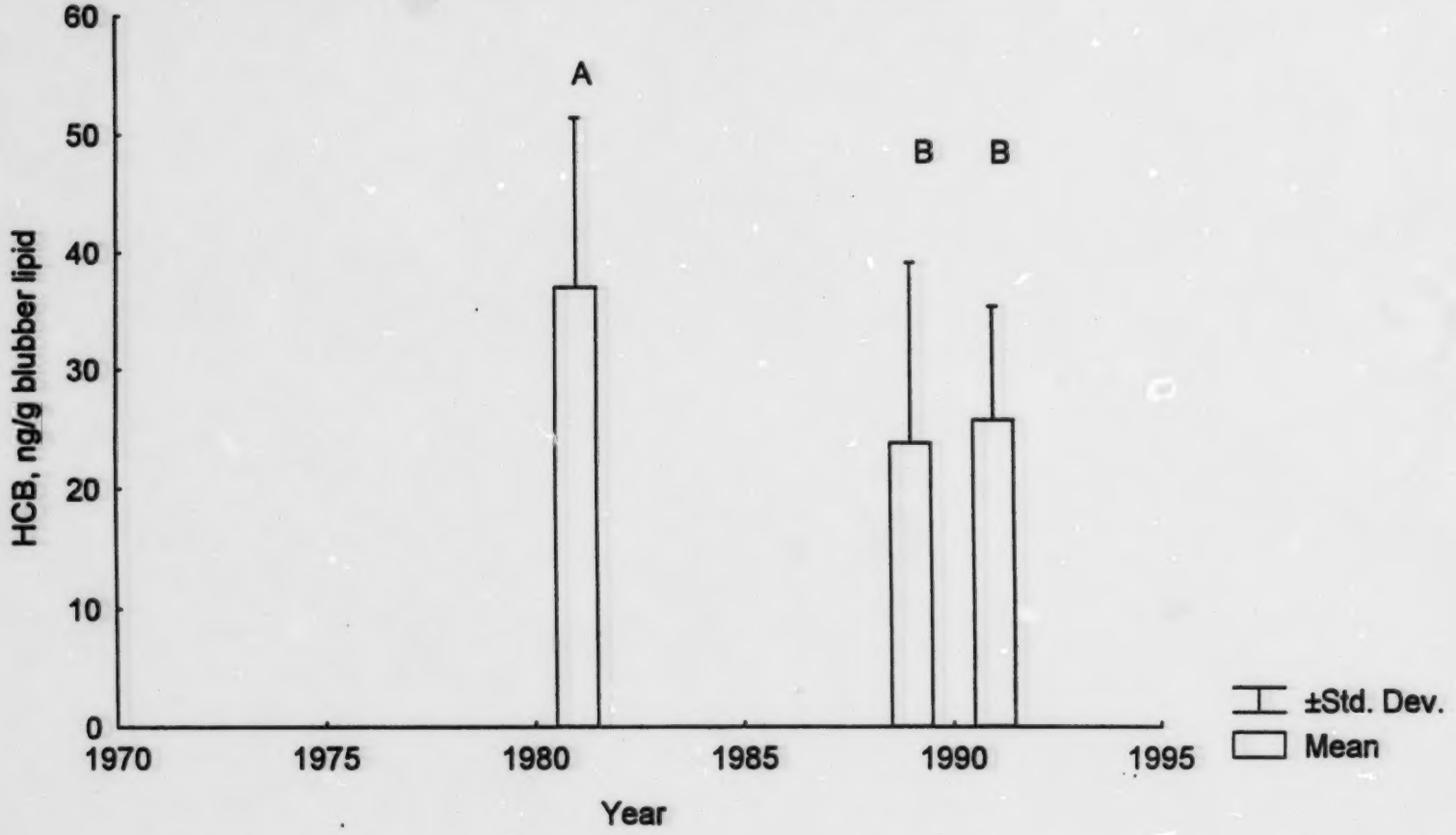


FIG. 17: Alpha-HCH in male Holman ringed seals 1981-1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

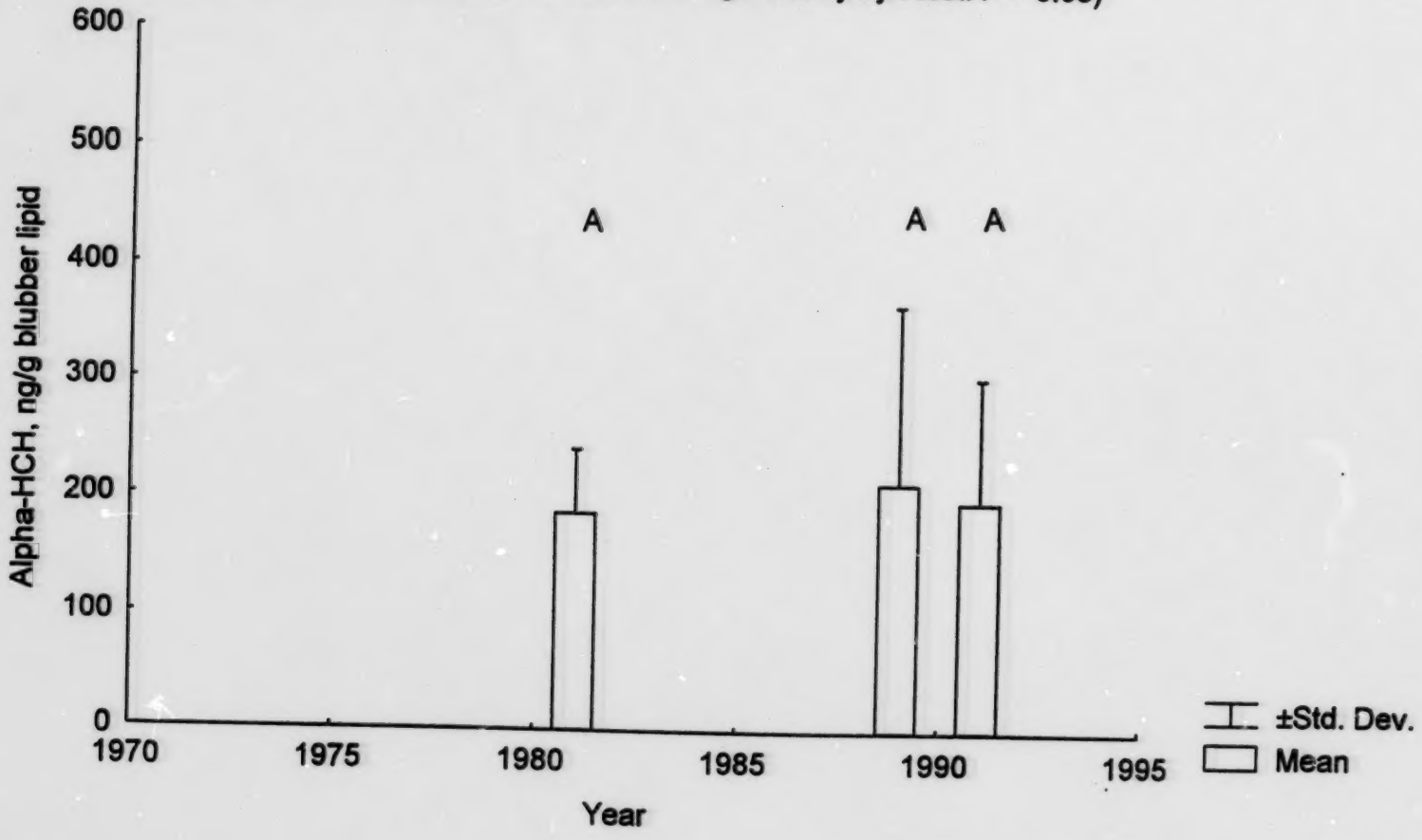
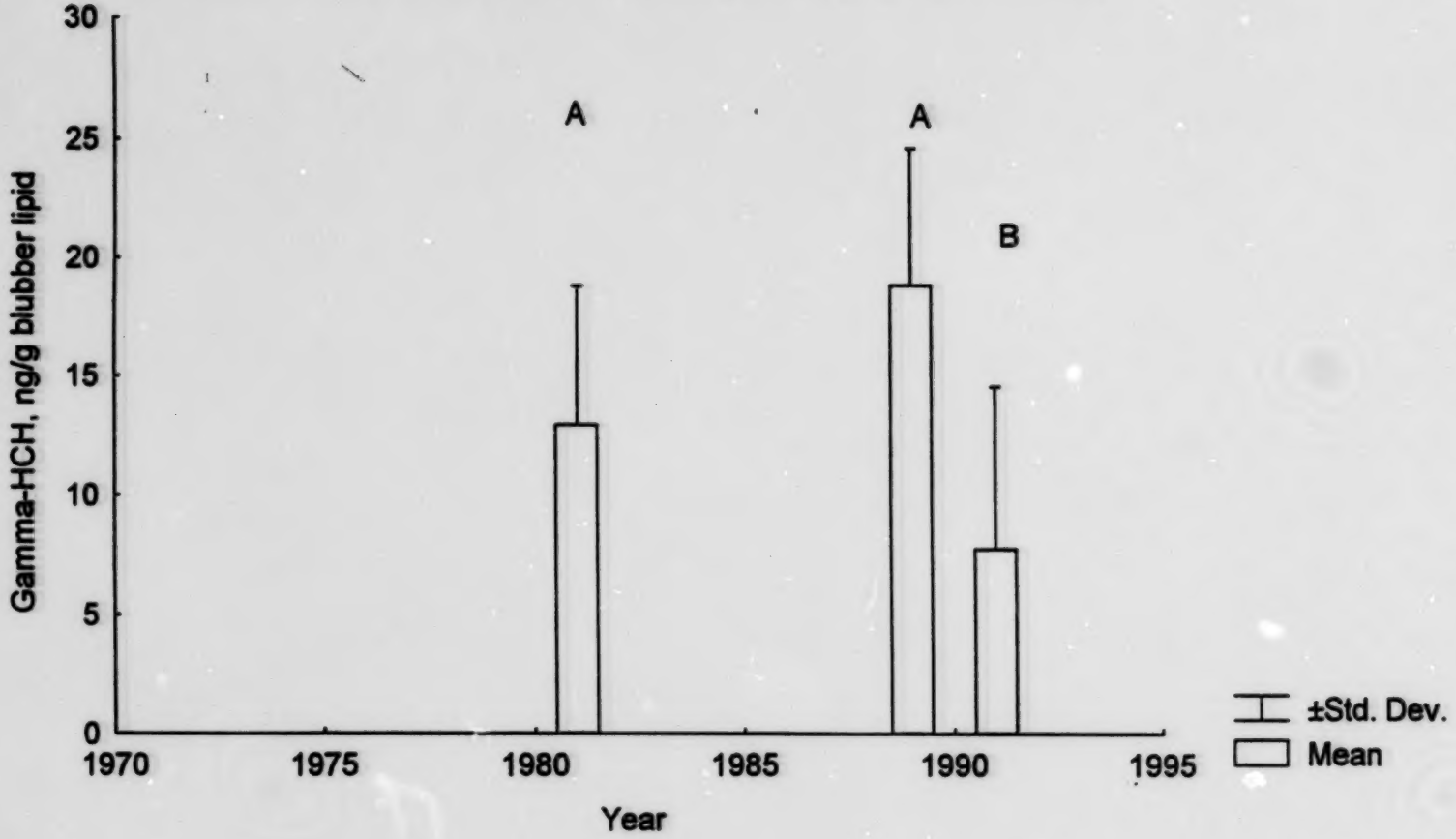
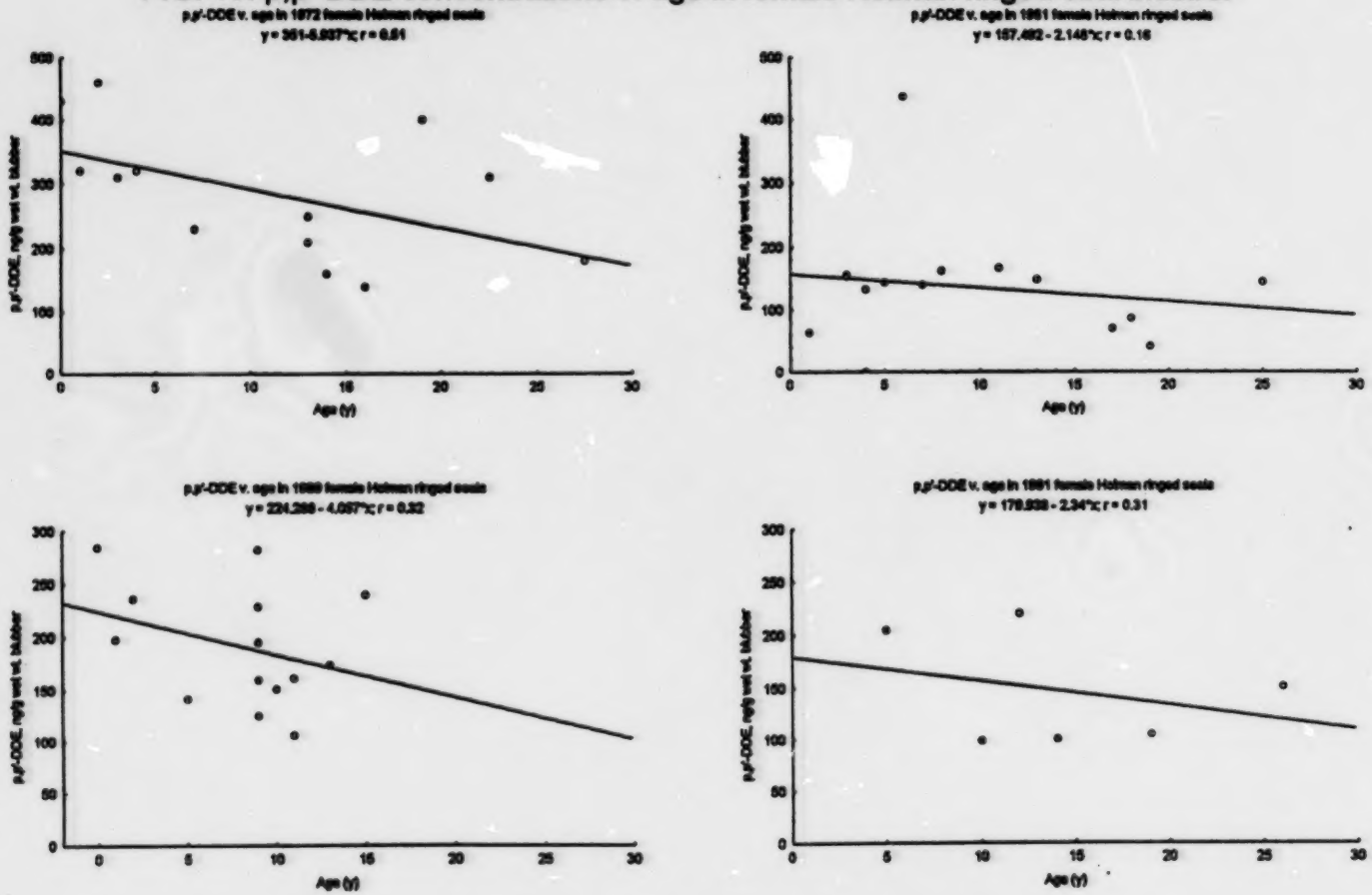


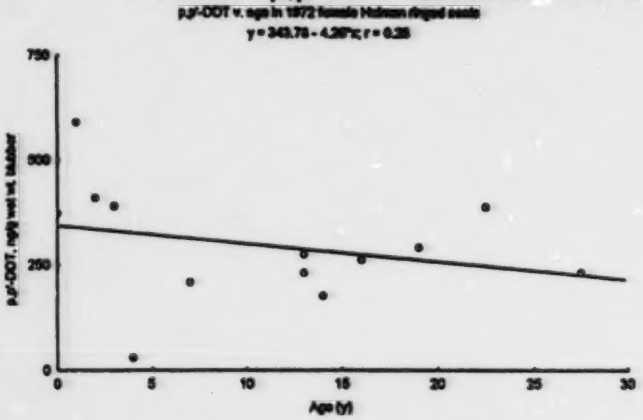
FIG. 18: Gamma-HCH in male Holman ringed seals 1981-1991
(Means with the same letter do not differ significantly by t-test: P > 0.05)

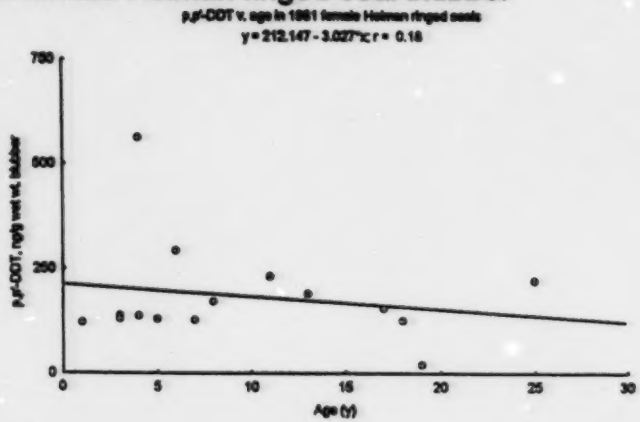


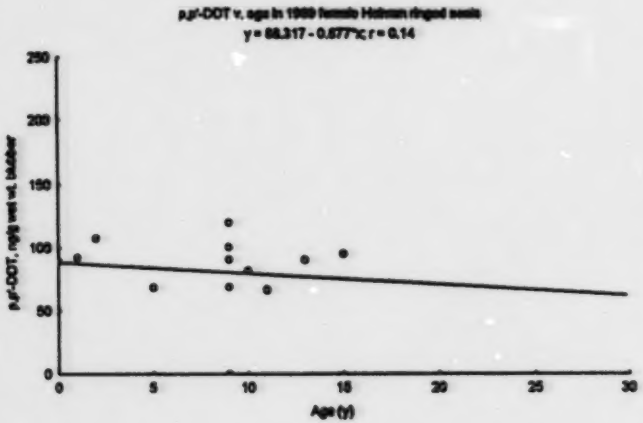
# FIG. 19: p,p'-DDE concentrations v. age in female Holman ringed seal blubber

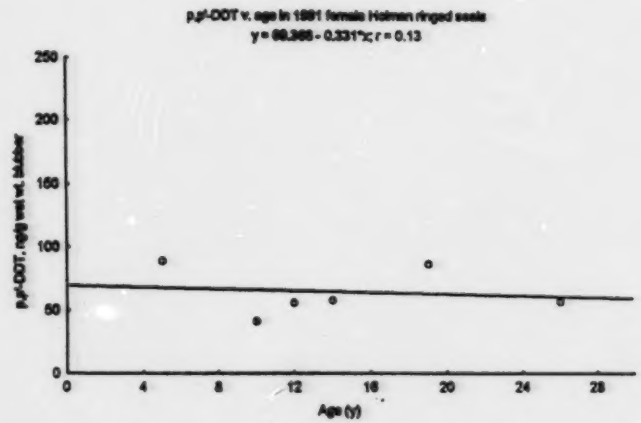

p,p'-DDE v. age in 1972 female Holman ringed seals
y = 361-6.937*x; r = 0.61
p,p'-DDE, ng/g wet wt. blubber
Age (y)
p,p'-DDE v. age in 1981 female Holman ringed seals
y = 157.492 - 2.148*x; r = 0.16
p,p'-DDE, ng/g wet wt. blubber
Age (y)
p,p'-DDE v. age in 1989 female Holman ringed seals
y = 224.288 - 4.087*x; r = 0.32
p,p'-DDE, ng/g wet wt. blubber
Age (y)
p,p'-DDE v. age in 1991 female Holman ringed seals
y = 179.939 - 2.34*x; r = 0.31
p,p'-DDE, ng/g wet wt. blubber
Age (y)

# FIG. 20: p,p'-DDT concentrations v. age in female Holman ringed seal blubber

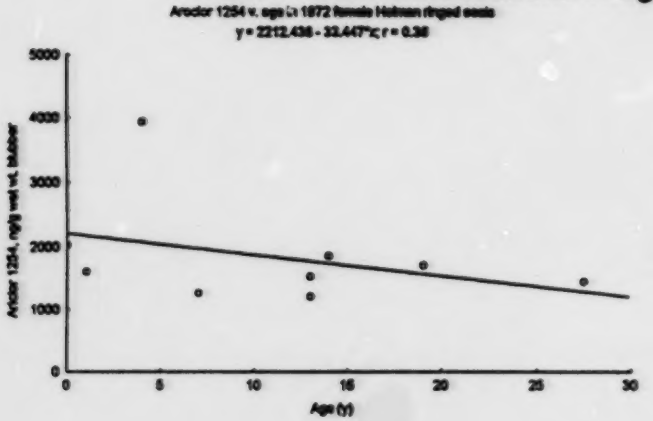


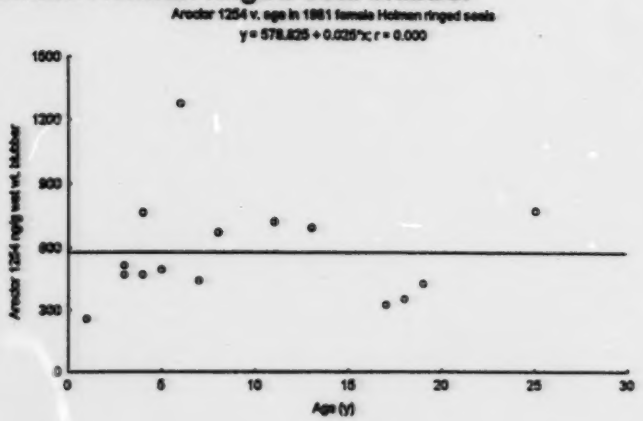



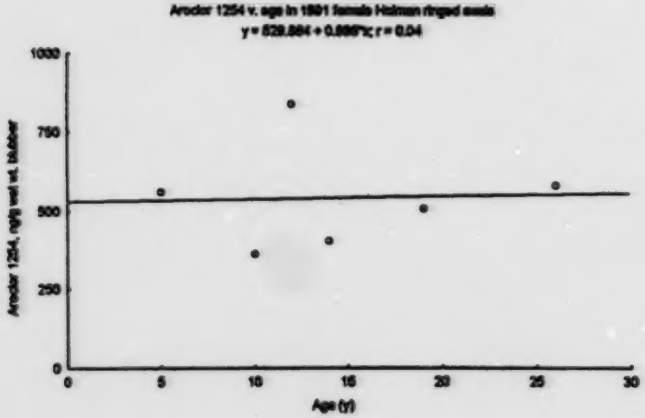



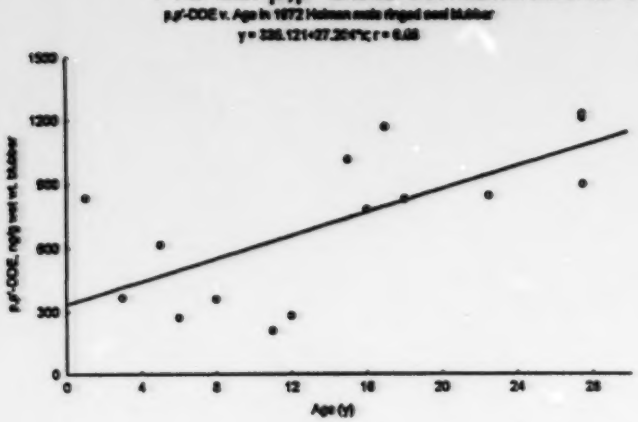
# FIG 21: PCB concentrations v. age in female Holman ringed seal blubber

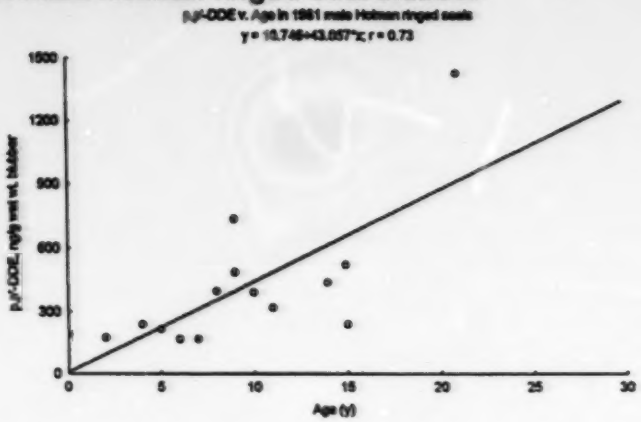


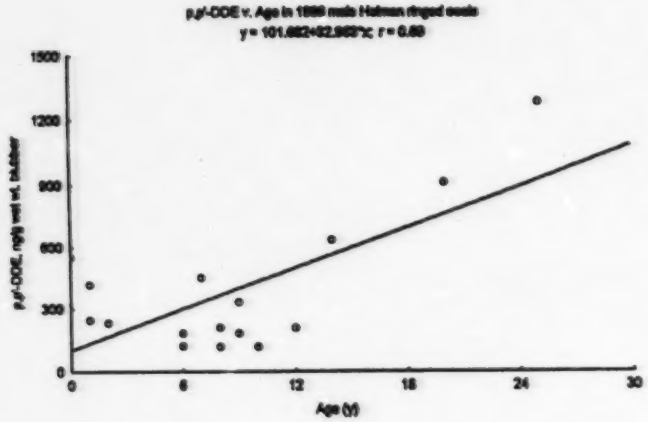



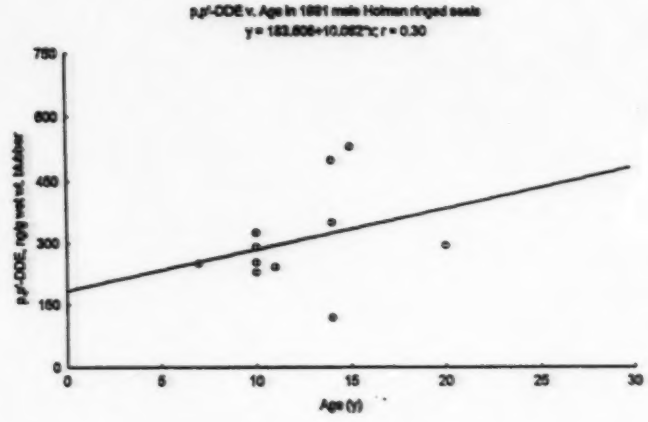



# FIG 22: p,p'-DDE concentrations v. age in male Holman ringed seal blubber

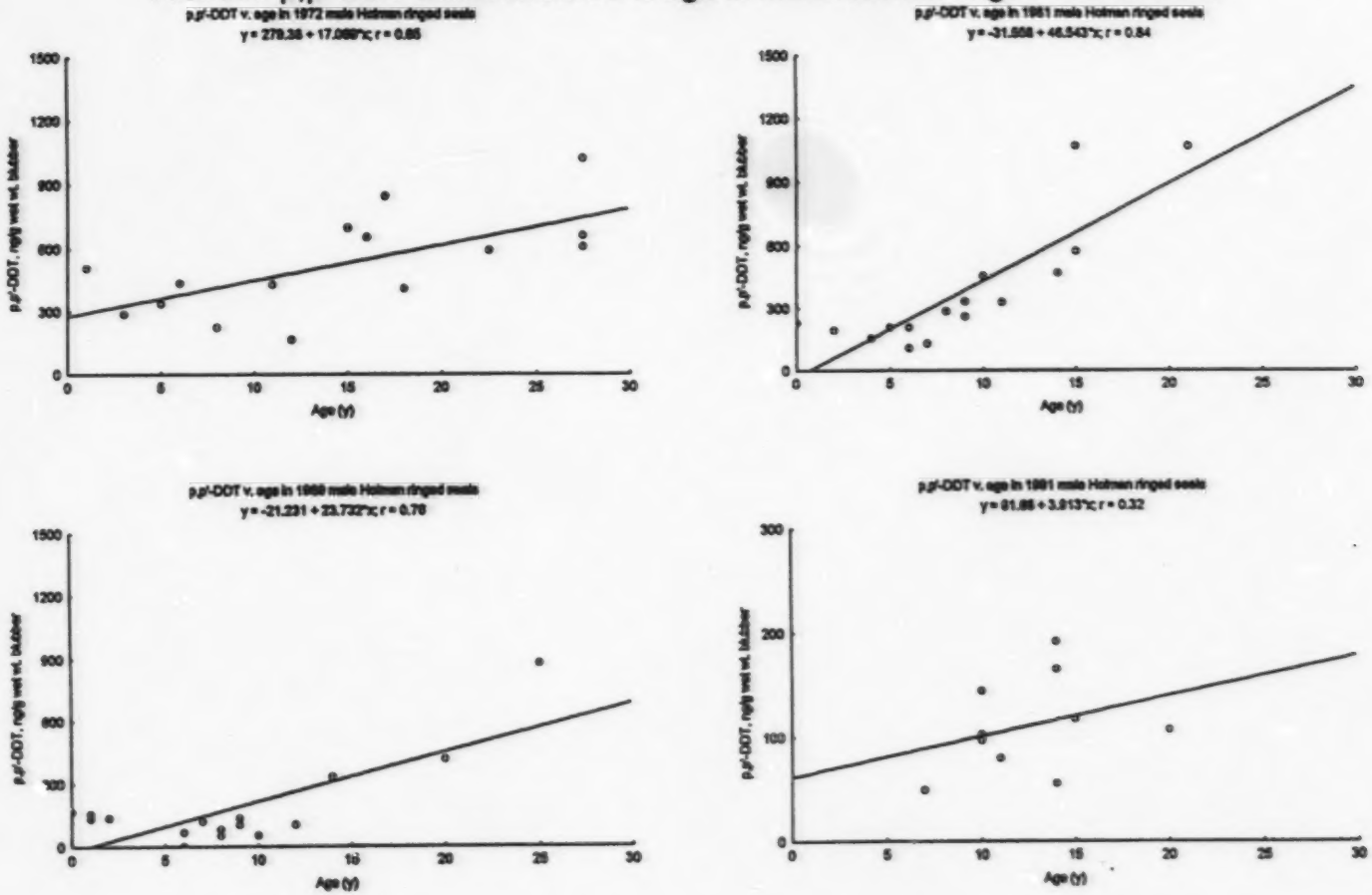


# FIG. 23: p,p'-DDT concentrations v. age in male Holman ringed seal blubber


p,p'-DDT v. age in 1972 male Holman ringed seals
y = 278.38 + 17.089*x; r = 0.85
p,p'-DDT, ng/g wet wt. blubber
Age (y)
p,p'-DDT v. age in 1981 male Holman ringed seals
y = -31.958 + 46.543*x; r = 0.84
p,p'-DDT, ng/g wet wt. blubber
Age (y)
p,p'-DDT v. age in 1988 male Holman ringed seals
y = -21.231 + 23.732*x; r = 0.76
p,p'-DDT, ng/g wet wt. blubber
Age (y)
p,p'-DDT v. age in 1991 male Holman ringed seals
y = 81.86 + 3.913*x; r = 0.32
p,p'-DDT, ng/g wet wt. blubber
Age (y)

# FIG. 24: PCB concentrations v. age in male Holman ringed seal blubber